HQ USAF REPORT

on the

SITE SELECTION FOR THE

CONSOLIDATED SPACE OPERATIONS CENTER

December 1979

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LIST OF ILLUSTRATIONS

GLOSSARY OF TERMS

ADC	Aerospace Defense Center
A-E	Architect-Engineer
AFB	Air Force Base
AFR	Air Force Regulation
AFS	Air Force Station
AFSC	Air Force Systems Command
AFSCF	Air Force Satellite Control Facility
AFSS	Air Force Security Service
ASC	AUTODIN Switching Center
ASD	Aeronautical Systems Division
AUTOSEVOCOM	Automatic Secure Voice Communications
AUTODIN	Automatic Digital Information Network
AUTOVON	Automatic Voice Network
ASPR	Armed Services Procurement Regulation
BOQ	Bachelor Officers Quarters
BOS	Base Operating Support
CBPO	Consolidated Base Personnel Office
CCPO	Consolidated Civilian Personnel Office
CEQ	Council on Environmental Quality
CES	Candidate Environmental Statement
CM	Controlled Mode
CONUS	Continental United States
CSOC	Consolidated Space Operations Center--Consolidates both Satellite & Shuttle Operations Functions

CY	Calendar Year
DCA	Defense Communications Agency
DES	Draft Environmental Statement
DET	Detachment
DLT	Data Link Terminal
DMJM	Daniel, Mann, Johnson and Mendenhall: A-E
DOD	Department of Defense
DOMSAT	Domestic Satellite
DSCS	Defense Satellite Communications System
DSTE	Digital Subscriber Terminal Equipment
DT&E	Development Test and Evaluation
E&A	Engineering and Administration
EASTPAC	Eastern Pacific (DSCS Satellite)
ECAC	Electromagnetic Capability Analysis Center
EED	Electro-Explosive Devices
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
EMR	Electromagnetic Radiation
FAMCAMP	Family Camp
FES	Final Environmental Statement
FOV	Field-Of-View
FY	Fiscal Year
GHz	Gigahertz

GTS	Guam Tracking Station
HQ	Headquarters
HTS	Hawaii Tracking Station
IAP	International Airport
ICBM	Intercontinental Ballistic Missile
IOC	Initial Operating Capability
IUS	Inertial Upper Stage
LOGAIR	Logistics Air
MCP	Military Construction Program
MWR	Morale, Welfare, and Recreation
NASA	National Aeronautical and Space Administration
O&M	Operations and Maintenance
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Agency
OT&E	Operational Test & Evaluation
RCC	Range Control Complex
RFI	Radio Frequency Interference
RTS	Remote Tracking Station
SAGE	Semi-Automatic Ground Environment
SAMSO	Space and Missile Systems Organization
SATCOM	Satellite Communications
SCDRS	Satellite Control and Data Relay System

SCF	Satellite Control Facility
SD	Space Division (Formerly known as SAMSO)
SECORD	Secure Switchboard
SOC	Satellite Operations Center Portion of CSOC (Formerly known as STC II)
SOPC	Shuttle Operations and Planning Center portion of CSOC
SPADOC	Space Defense Operations Center
SPO	System Program Office
STC	Satellite Test Center
STC II	Satellite Test Center Two, Now Known as Satellite Operations Center (SOC) portion of CSOC
TAC	Tactical Air Command
TBD	To be Determined
TDY	Temporary Duty
TDRSS	Tracking and Data Relay Satellite System
TT&C	Telemetry, Tracking, and Commanding
VOQ	Visitor Officers Quarters
WESTPAC	Western Pacific (DSCS Satellite)

Section I
Introduction

1.1 The purpose of this final report is to consolidate the wealth of information that has been gathered over the past several years concerning the requirement for, and the site selection of a Consolidated Space Operations Center (CSOC).

1.1.1. This report will begin in section 1 with the historical background which led to the selection of the final three candidate sites of Malmstrom AFB, Montana; Peterson AFB/Colorado Springs area; and Kirtland AFB, New Mexico. Section 2 will discuss program requirements of the CSOC specifically addressing the two major mission elements: Satellite Operation Center (SOC) and Shuttle Operations and Planning Center (SOPC).

1.1.2. Section 3 of this report is a summary that provides the criteria and rationale/methodology used in the selection of a final CSOC site.

1.1.3. Attached to this final report are three annexes that contain the supporting documentation which led to the final site selection of the Colorado Springs area subject to successful completion of the environmental impact analysis process and land acquisition.

1.2 Historical Background: In May 1978 the Air Force Satellite Control Facility (AFSCF) of Air Force Systems Command conducted site surveys at Luke Air Force Base (AFB), Arizona; Nellis AFB, Nevada; Hill AFB, Utah; Mountain Home AFB, Idaho; and Malmstrom AFB, Montana. In November 1978 AFSCF conducted additional site surveys at Kirtland AFB, New Mexico; Buckley Air National Guard Base (ANGB), Colorado; and Peterson AFB, Colorado. Four more Air Force installations were added to the survey list in January 1979 to bring the total number surveyed to twelve. The four were the North American Air Defense (NORAD) Cheyenne Mountain Complex, Colorado; Offutt Air Force Base, Nebraska; Duluth International Airport, Minnesota; and Hancock Field, New York. During these surveys extensive data was collected from the installations on factors which would affect siting of the Satellite Operations Center (previously known as Satellite Test Center II (STC II) or a combined Space Operations Center/Shuttle Operations and Planning Center.

1.2.1. In February 1979 the Office of Management and Budget (OMB) requested the Department of Defense (DOD) & the National Aeronautics and Space Administration (NASA) to evaluate whether a joint mission control center or separate DOD and NASA facilities should be used to meet post 1985 Shuttle mission requirements. The outcome of the OMB directed study effort resulted in the Air Force recommendation that the two mission elements of the Satellite Operations Center and Shuttle Operation Planning Center be collocated into the Consolidated Space Operations Center (CSOC).

1.2.2 In August 1979 at the direction of the Secretary of the Air Force a Headquarters United States Air Force (HQ USAF) working group was formed to review, validate criteria and update data that was used to narrow the selection to three candidate sites. Additionally, a HQ USAF survey team was formed to evaluate the three final candidate sites of Malmstrom AFB, Montana, Peterson AFB, Colorado, and Kirtland AFB, New Mexico. The results of that HQ USAF site survey are contained in Annex B. HQ USAF then evaluated the operational and organizational factors of locating CSOC at each of the three candidate sites. Annex C contains the results of that evaluation.

SECTION 2

PROGRAM CONCEPT

2.1 This section presents a description of the CSOC program. Subjects covered include the requirements for both the SOC and SOPC, the CSOC facility, real estate and manpower requirements, and the major milestones which must be met in order to achieve an initial operating capability (IOC) of June 1985. The requirement for a CSOC, consolidation of a SOC and SOPC was generated by the following factors.

2.2 SOC Requirements

2.2.1 Mission Requirements:

2.2.1.1 The present Air Force Satellite Test Center (STC), located at Sunnyvale, CA is a single, critical node in the Air Force Satellite Control Facility (AFSCF) network for performing satellite telemetry, tracking and command functions for a large majority of military missions. The STC is vulnerable to both environmental and man-made threats. In addition, the STC facilities are fully utilized and have limited operational flexibility and growth potential.

2.2.1.2 The SOC would provide a second node for command and control of satellites and would be located to avoid environmental and man-made threats. Also, SOC facilities would be constructed to incorporate operational flexibility and growth potential.

2.2.2 Operations Concept. The SOC will share the normal AFSCF satellite support workload with the STC. If the STC becomes inoperative for any reason, the SOC will assume responsibility for the satellite programs usually assigned to the STC. Under these circumstances, cross-trained space vehicle operations personnel at the SOC will (1) execute essential Telemetry, Tracking andCommand (TT&C) and mission support functions for high priority programs and (2) provide minimum acceptable health and status support for the remaining programs. Range operations personnel at the SOC will schedule and configure all available network resources. (During normal operations, range management functions will

be performed at, and lead responsibility periodically transferred between, the STC and the SOC.)

2.2.2.1 If the outage at the STC is a long-term one, STC personnel will be transported to the SOC. This will allow personnel working extended shifts at the SOC to revert to a standard schedule and will permit the gradual resumption of most satellite control functions. With the additional personnel, the SOC will have the capability to provide a near-normal level of support to the entire AFSCF satellite inventory, albeit under crowded working conditions.

2.2.3 Staffing and Facilities. Under normal circumstances - STC and SOC operational - total SOC staffing is projected to be between 1100 and 1200 individuals. The exact figure is dependent on which satellite programs are assigned to the SOC, what manning is required for the AFSCF data systems now being defined, and what support is available from the host base. It should be noted that some functions (hence personnel) will be transferred from the STC to the SOC. The SOC facility will consist of a Technical Building (where the vast majority of the staff will work), an Engineering and Adminsitration (E&A) Building a Central Plant for utility systems, five antenna systems, and various smaller buildings and support structures. The fenced complex will occupy approximately 107 acres and be surrounded by a (larger) safety and security buffer zone (Figure 2-1). Floor space for these facilities are summarized in the following table.

Table 2-1 SOC Facility Floor Space Requirements

FACILITY	AREA (ft^2)
E&A Building	55,800
Tech Building	232,500
Power Plant	29,770
Corridors/Dock	1,600
Support Building	23,000
Terminal Building	6,700
Antenna Support Structure	10,000
Guard House	300
Total	359,670

2.3 SOPC Requirements

2.3.1 Mission Requirements

Military Uses of Space: 1946-1991

Published by:
Chadwyck-Healey Inc., 1101 King Street, Alexandria, Virginia 22314

Military Uses of Space: 1946-1991 provides a detailed record of the strategic importance of the U.S. military space program from the conceptualization of the uses of space to the present realization of advanced capabilities. Materials were identified, obtained, assembled, and indexed by the National Security Archive, a non-profit, Washington, D.C. based research institute and library. The microfiche collection is accompanied by Military Uses of Space: 1946-1991 Guide and Index.

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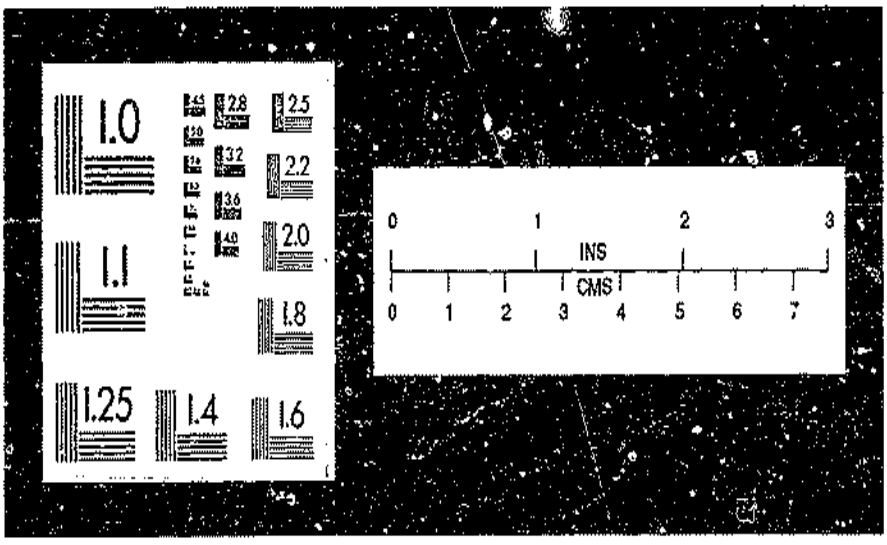

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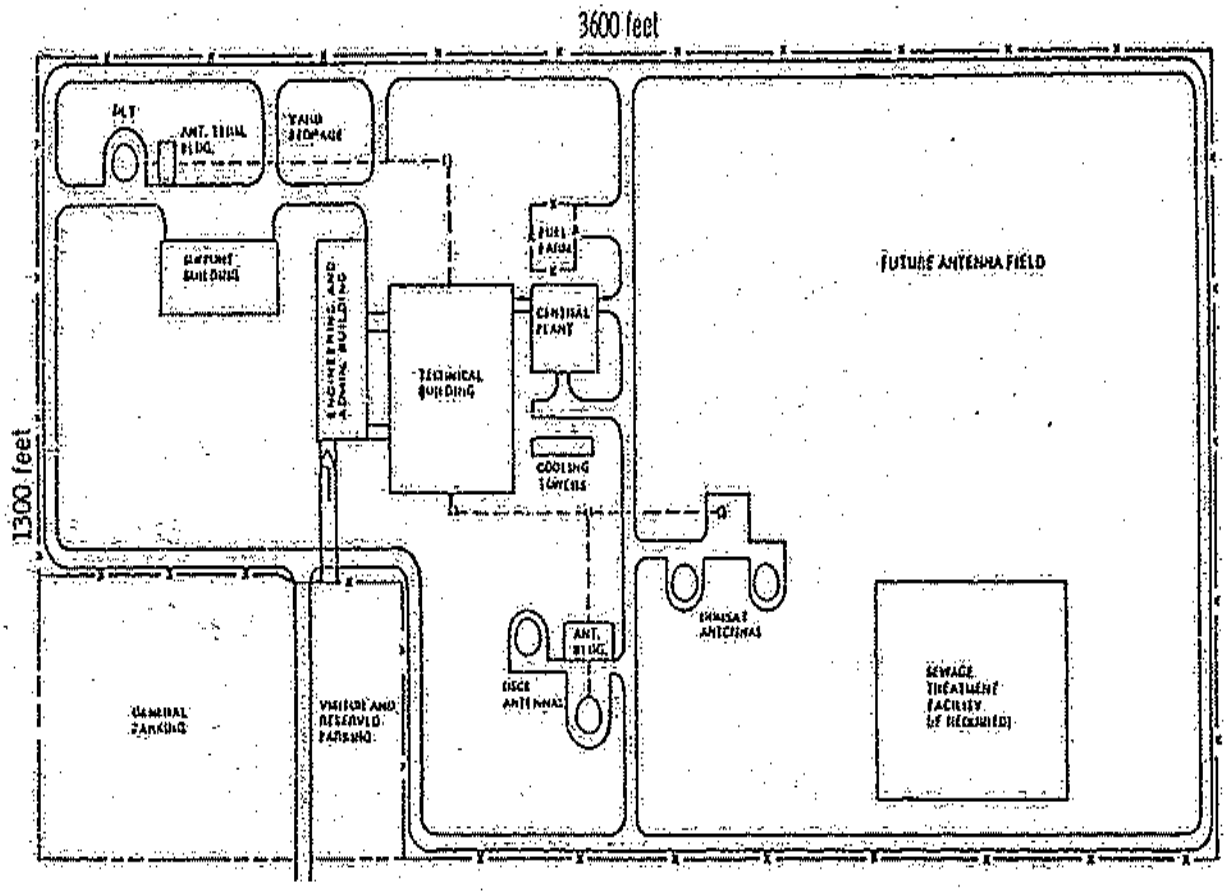

Figure 2-1 Satellite Operations Center Site Plan

2.3.1.1 The present DOD Shuttle operations Controlled Mode (resident at the Johnson Space Center) will manage early DOD Shuttle operations. However, the Johnson Space Center (JSC) does not meet all DOD requirements for the planning and conduct of DOD missions. The JSC Controlled Mode (CM) was designed to provide protection to the SECRET classification level only. No provisions have been made for planning, simulation or control of DOD missions requiring classification higher than SECRET. Some DOD missions will require protection above the secret level. In addition JSC is located in a region susceptible to environmental and man-made threats. Finally the JSC is workload and growth limited and does not provide for direct and continuing command and control over military operations.

2.3.1.2 The SOPC would provide increased security, be located in an area relatively free of natural threat, would provide a second node for conducting shuttle operations, and would provide the DOD direct mission authority over DOD shuttle operations.

2.3.2 Operations Concept. All shuttle flight planning, readiness, and control operations in support of DOD flights will be performed in a separate secure SOPC operated by DOD personnel. The Inertial Upper Stage (IUS) and payload mission operations continue to be supported by the AFSCF as in CM operations, but with the interface being with the SOPC rather than JSC. The NASA Tracking & Data Relay Satellite System (TDRSS) provides primary communications and tracking support, with the SCF, Remote Tracking Station (RTS) network providing backup communications and tracking support for Shuttle operations. The SOPC will conduct the flight planning, flight readiness, and flight control functions as outlined below.

2.3.2.1 Flight Control. The SOPC flight control system will interface with both the DOD SCF network and the NASA TDRSS network. A NASA-like flight control system at the SOPC will provide extensive online processing and display of telemetry, command, and trajectory data. The capability to support two simultaneous operations with complete program data privacy (including redundant processing for support of a critical mission phase) will be provided. Any combination of two mission operations, (selected from real-time mission operations, launch pad test operations, and integrated simulations) could be supported simultaneously. The SOPC flight control system will be interfaced with a secure Fixed Base Crew Station (FBCS) simulator, located at the SOPC, for integrated simulations involving the flight crew and flight operations support personnel. Extensive contingency support capability will be provided by the SOPC flight control system, FBCS simulator, flight planning systems, and team of flight support personnel.

2.3.2.2 Flight Readiness. NASA will manage and conduct basic, advanced, and recurring training for all flight crews using NASA

facilities and personnel. DOD will provide flight-specific training equivalent to that provided by NASA for similar missions through a combination of unclassified NASA trainers (eg, Orbiter Neutral Buoyancy Trainer and Shuttle Training Aircraft), secure SOPC classrooms, and the SOPC FBCS simulator. DOD will also perform all necessary training of SOPC flight operations support personnel for DOD flights using SOPC classrooms, and integrated simulations involving the flight crew in the SOPC FBCS simulator and support personnel manning their SOPC flight control positions.

2.3.2.3 Flight Planning The SOPC flight planning will take full advantage of the flight planning systems and techniques developed for NASA. The SOPC capabilities include a long-range planning system, an operational flight design system, and a crew activity planning system.

2.3.3 Staffing and Facilities. Staffing for the SOPC totals approximately 600-700 personnel when collocated with the SOC in the CSOC. Required expansions (Figure 2-2) to the baseline SOC facility are as follows: technical building 91,800 ft^2, utilities plant expansion, 9000ft^2, and antenna support structures 1500ft^2. (Figure 2-3)

2.4 Growth Potential. Expansion of the overall facility, i.e., substantial growth in the size and/or number of structures and antenna systems, is being considered as an integral part of the design process. Exterior space has been set aside for (and interior layouts have taken into account) the possibility of larger technical, E&A, and utility plant buildings, either initially or in the late 1980s. Acreage has also been reserved for new buildings and additional antenna systems. These growth provisions will facilitate assimilation of TT&C operations for future satellite programs and cost effective addition of ground support facilities for major space systems (such as the Shuttle) at the Satellite Operations Center.

2.5 Milestones. Figure 2-4 reflects the general milestone schedule for the CSOC. A beneficial occupancy date (BOD) of end CY 83 is shown for the entire CSOC facility. The flight planning element (FPE) of the SOPC will become operational at the end of CY 83, with the first full mission operations shown in mid-85. The SOC IOC is also depicted in mid-85.

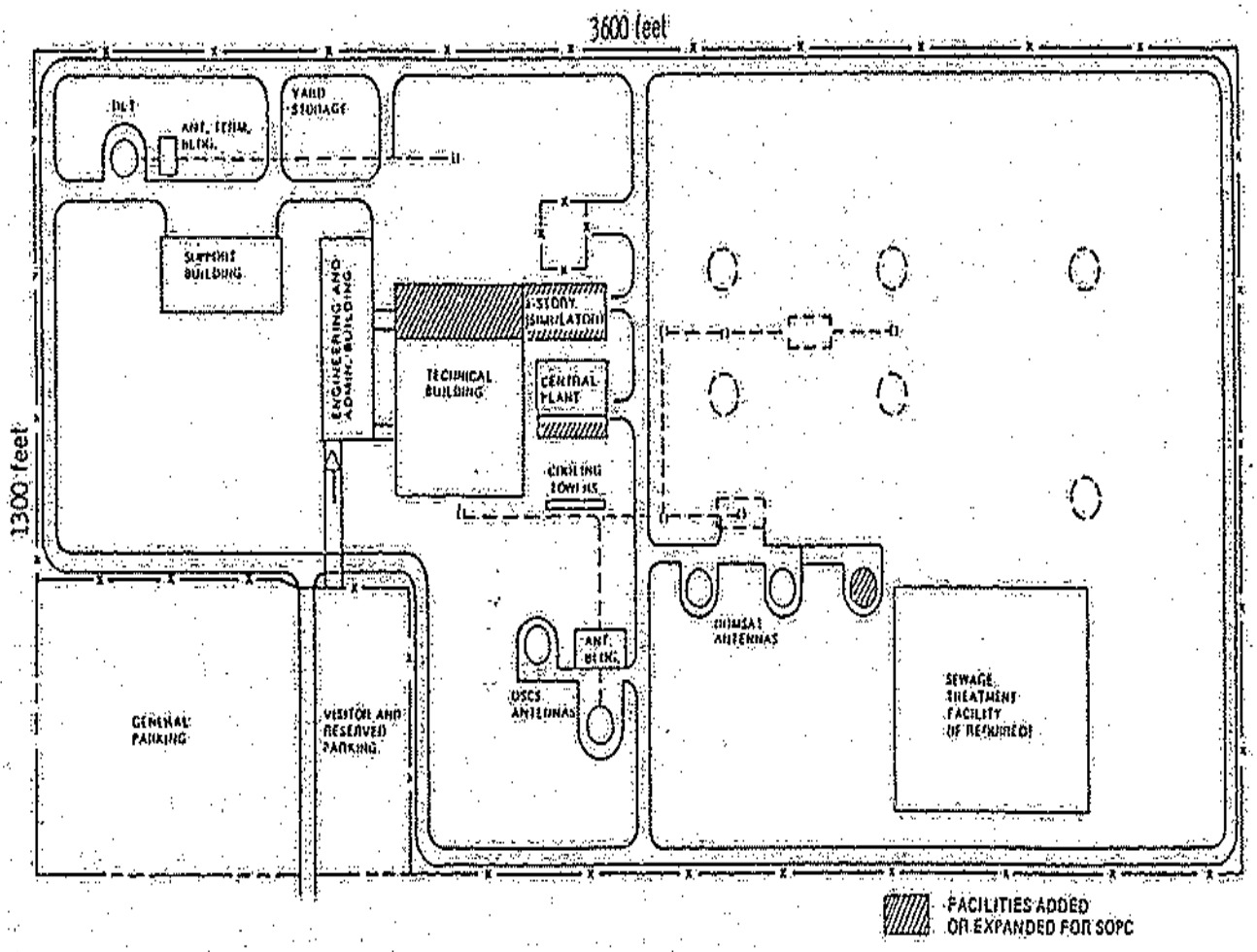

Figure 2-2 SOPC Facility at SOC - Representative Site Layout

TOTAL CSOC FACILITIES REQUIREMENTS

Requirements (Sq. Ft.)	SOPC Facility	SOC Facility
Technical Bldg	91,800	232.500
Power Plant	9,000	29,770
Antenna Support Structure	1,500	10,000
Other	-------	87,400
SUBTOTAL	102,300	359,670
TOTAL	461,970	

Figure 2-3

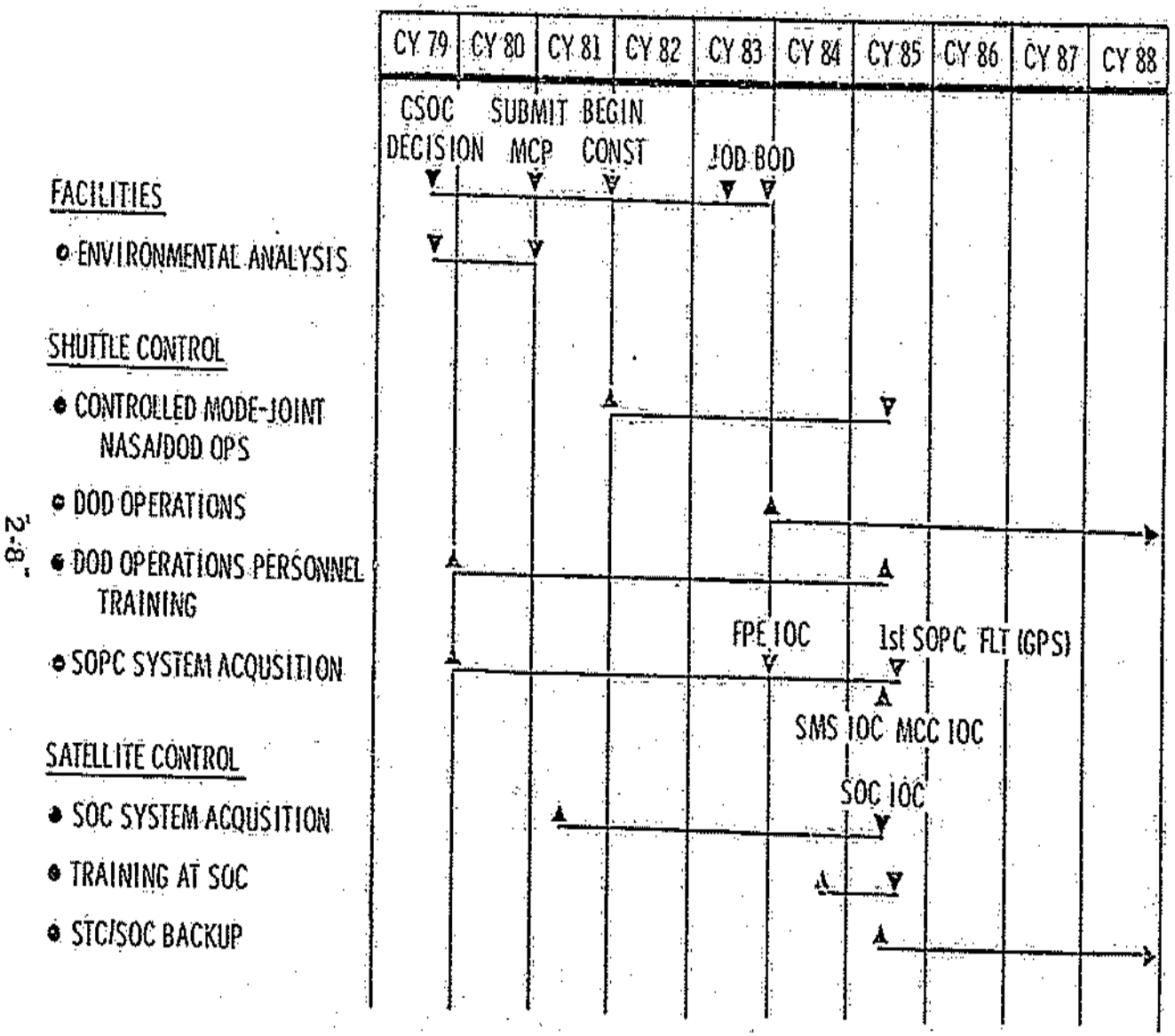

Figure 2-4 CSOC Milestone Schedule

SECTION 3

SUMMARY

3.1 Overview: This section presents a summary of the decision process which led to the selection of Peterson AFB/Colorado Springs area as the preferred site for locating the CSOC. First a review of the site selection criteria used in Site Surveys 78-21 and 79-26 is discussed, followed by summaries of the results of these surveys. Finally, the operational and organizational factors which weigh in the site selection are discussed.

3.1.1 As discussed earlier, Site Survey 78-21 investigated twelve continental United States (CONUS) sites identified as candidate locations for the SOC, then called STC II. These twelve sites were selected as candidates by screening all of the CONUS against the selection criteria. As a result of Survey 78-21 (conducted in May 78, November 78 and January 79) candidate sites for CSOC were reduced from twelve to three, Malmstrom AFB, Great Falls, Montana; Peterson AFB, Colorado Springs, Colorado; and Kirtland AFB, Albuquerque, New Mexico. These sites were chosen because they best satisfied the requirements of the CSOC criteria.

3.1.2 From the OMB directed studies on Satellite and Shuttle Control Capabilities, a programmatic decision was made to consolidate the SOC and SOPC into the CSOC, providing the opportunity for the sharing of technical resources and reducing life cycle costs. Subsequently, the Secretary of the Air Force directed, on 8 Aug 79, that the remaining three candidate sites be resurveyed for locating the CSOC; in order to update the technical data; to determine the impact the CSOC mission requirements would have on each candidate base; to perform a preliminary, informal environmental analysis; and to investigate the potential use of existing facilities to reduce CSOC facility costs. The general conclusions of this survey stated there were no overriding technical, environmental or base support reasons for selecting one site over another, although Kirtland AFB showed the lowest initial estimated military construction program costs.

3.1.3 Subsequent to Site Survey 79-26, the three candidate sites were evaluated against operational and organizational factors. These factors affect not only the effectiveness and efficiency of the CSOC, but also the life cycle costs. This evaluation resulted in Peterson AFB being selected as the preferred location of the CSOC.

3.1.3.1 Peterson Air Force Base was selected as the prime candidate because of its unique operational advantages which accrue from proximity to related space operations activities, i.e., the Space Defense Operations Center (SPADOC) activities of the North American Air Defense Command at the USAF Cheyenne Mountain Complex. Proximate location of CSOC and SPADOC would provide a foundation for significant, long-term

operational efficiencies stemming from convenient, face-to-face planning as well as shared support assets. In this regard, SPADOC will be able to provide the CSOC with a link into the existing space surveillance and warning structure. The proximate siting of these two functions also offers flexibility to accommodate future, unfolding defense missions in the medium of space.

3.2 Site Selection Criteria: The Site Selection criteria presented below were developed for Site Survey 78-21 and used by that survey for evaluating the twelve candidate sites for locating the SOC, then known as STC II. Subsequent to the decision to consolidate the SOC and SOPC, these criteria were validated by Headquarters Air Force Systems Command and by Headquarters USAF for evaluating a site for locating the newly established CSOC. Except for some terminology/acronym changes, the site selection criteria resulting from this validation were essentially unchanged from those used in Site Survey 78-21. The seventeen criteria used are organized into eight major categories, and are described by giving the definition of each criterion and the reason it is a criterion.

3.2.1 Satellite Communications:

3.2.1.1 Adequate Defense Satellite Communications System (DSCS) Satellite Visibility: Both Defense Communications Agency (DCA) Pacific communications satellites should be visible from the site. The preferred elevation angle is 10 degrees or greater, and the nominal minimum angle established by DCA is 5 degrees. (Note: Subsequent to Site Survey 78-21, an investigation was conducted on possibility of moving DSCS WESTPAC. DCA stated that moving of WESTPAC was not feasible.)

3.2.1.1.2 Rationale: DSCS satellites are used for communications with the Remote Tracking Stations (RTSs). Visibility of both Pacific satellites (WESTPAC and EASTPAC) reduces the number of multiple hops to RTSs, thereby increasing communications reliability and decreasing overall DCA satellite and system loading.

3.2.1.2 Tracking and Data Relay Satellite System (TDRSS) Visibility: Siting the CSOC within the footprint of the TDRSS satellite would allow location of a TDRSS ground entry point at the CSOC.

3.2.1.2.1 Rationale: During the mid-1980s, TDRSS will provide the prime communications link between the Space Transportation System (STS) Orbiter and the facility controlling DOD STS missions. The high data rate transfer and near worldwide coverage capability of TDRSS can be used by DOD satellites for continuous payload readout and immediate realtime satellite command and control capabilities. A TDRSS terminal at the CSOC could also provide a backup for the NASA terminal at White Sands.

3.2.1.3 Minimum Local Obscura: Nearby facilities and terrain features must not obscure the line of sight between the antennas collocated at the CSOC and the satellites with which they communicate.

3.2.1.3.1 Rationale: Elevation angles for the CSOC antennas range as low as 3 degrees. Local obscura compromise and potentially negate the ability of CSOC to carry out its support mission.

3.2.2 Electromagnetic Phenomena:

3.2.2.1 Mission Compatibility Electromagnetic and Radio Frequency Interference (EMI/RFI): The CSOC antenna field must be away from known sources (e.g., radars) of electromagnetic energy of power density sufficient to disrupt operations.

3.2.2.1.1 Rationale: Nearby sources of electromagnetic and radio frequency interference (EMI and RFI) potentially degrade or interrupt CSOC communications via satellite. Conversely, CSOC antenna emissions might interfere with nearby ground-based electronics equipment.

3.2.2.2 Mission Compatibility Aircraft Operations: The CSOC antenna field must be sufficiently distant from aircraft traffic patterns to minimize (1) hazards to aircraft, and (2) physical blockage of the antenna beams.

3.2.2.2.1 Rationale: Electromagnetic emissions from the CSOC antennas can potentially affect aircraft avionics or activate electro-explosive devices (EEDs), endangering aircraft safety. Conversely, communications between satellites and CSOC antennas might be interrupted when an aircraft flies through the beam.

3.2.2.3 Acceptable Electromagnetic Radiation (EMR) Exposure: In addition to the space provided by the basic CSOC site plan, a safety buffer zone extending 1000 feet outside the antenna field must be provided to prevent encroachment by future building construction which could result in EMR hazards to personnel.

3.2.2.3.1 Rationale: Increasingly stringent EMR standards are being promulgated to protect human health and safety. In addition, CSOC antennas must have an unobstructed field of view at relatively low elevation angles.

3.2.3 Security:

3.2.3.1 Minimum Natural Threats: CSOC must be sited outside areas with high potential for natural disasters.

3.2.3.1.1 Rationale: A principal justification for the CSOC program is the vulnerability of the existing STC to earthquakes and Johnson Space Center (JSC) to flood/hurricane. Siting CSOC in an area prone to natural disasters such as floods, earthquakes, tornados, or hurricanes completely contravenes the objective of reduced vulnerability.

3.2.3.2 Minimize Physical Threats: Locate CSOC away from populated areas, roadways, and public areas.

3.2.3.2.1 Rationale: Siting CSOC so as to limit awareness of, and restrict proximate access to the facilities improves security.

3.2.4 Real Estate:

3.2.4.1 On Federal Property: CSOC should be sited on federal property.

3.2.4.1.1 Rationale: The cost and time necessary to procure non-federal property may be unacceptable in view of the existing inventory of federal property and the time constraints on the CSOC implementation schedule.

3.2.4.2 Sufficient Acreage: A minimum of 107 acres must be provided for the basic CSOC site plan.

3.2.4.2.1 Rationale: The area incorporating and surrounding the CSOC facilities, must be large enough to avoid interference among the antennas and buildings, to provide physical security and physiological safety, and to accommodate likely expansion.

3.2.5 Future Communications:

3.2.5.1 Maximum Clear, Dry Weather: CSOC must be sited in an area providing maximum cloud-free, precipitation-free, and moisture-free lines-of-sight between its antennas and orbiting communications satellites.

3.2.5.1.1 Rationale: A potential requirement for the mid-1980's is the accommodation of greatly increased mission data rates between satellites and space ground systems. These very high data rates (up to several gigabits) require extremely large bandwidths which can only be achieved by using millimeter wave or laser communications. Such high frequency waves are severely attenuated by water vapor, precipitation, etc., to the extent that disruption to communication links can occur. Therefore, the facility must be sited in an area which provides the maximum practical clear, dry weather in order to perform its mission.

3.2.5.2 Electronic Threat: CSOC should be sited far enough inland from coastal waters and international boundaries to minimize potential for interruption of space-ground communications.

3.2.5.2.1 Rationale: Potential compromise of and/or interference with CSOC communications represent a threat to its ability to support vital DOD space missions and resources. Based on an analysis of

anticipated threats and projected state-of-the-art technology for satellite antenna design in the mid-1980's, the specified distances will provide sufficient protection to satellite uplinks and downlinks.

3.2.6 Future Expansion:

3.2.6.1 Additional Land Available: CSOC must be located such that additional land is available contiguous to the basic 107 acre site.

3.2.6.1.1 Rationale: Although adequate space is provided by the basic site plan for expected expansion of technical and support buildings and for associated antenna structures, necessary security and safety buffer zones require the ready availability of sufficient land.

3.2.7 Resource Utilization:

3.2.7.1 On/Near Active Base: CSOC should be sited on or within 50 miles of an active military installation.

3.2.7.1.1 Rationale: An active military installation provides support for military personnel such as hospital, medical, dental, commissary, personnel, exchange, and other services. Facilities support such as civil engineering services, security, and fire protection can also be provided if the new facility is located on or sufficiently close to a military installation. Fifty miles is considered a reasonable maximum and is representative of approximately one hour's driving time.

3.2.7.2 Existing Facilities Available: CSOC should be sited in a location which permits use of existing buildings/facilities.

3.2.7.2.1 Rationale: Use of existing facilities could significantly reduce cost. However, this criterion is dependent on the specific facilities available, modification costs, and other technical considerations.

3.2.8 Local Support:

3.2.8.1 Technical Personnel and Cultural/Educational Facilities: CSOC should be sited in an area which provides a source of technically trained personnel, community support services, cultural attractions, recreational areas, and educational opportunities.

3.2.8.1.1 Rationale: The operations concept for the facility requires large numbers of highly trained technical contractor personnel. Available community support and facilities should be sufficient to attract and retain the caliber of personnel required to support the mission.

3.2.8.2 Adequate Airline Service: CSOC should be sited within 50 miles of an airport with regularly scheduled and direct airline service to San Francisco/San Jose, Los Angeles, Houston and Washington, D.C.

3.2.8.2.1 Rationale: Personnel must be able to travel between the facility and other agencies (STC I, Space Division, contractor, JSC, USAF headquarters, etc.) without excessive delays. This is an important requirement in view of the rapid response required during satellite malfunctions and other contingencies which require the immediate transport of technical support personnel from Program Offices and contractors.

3.3 Site Survey 78-21 Summary: This section summarizes the site evaluation discussed in Annex A and draws conclusions on the technical acceptability and relative merits of the bases as they were evaluated against the criteria for location of the SOC. A matrix is included to assist in comparing the bases/sites in terms of the siting criteria and evaluation factors. The following material recounts the highlights of the evaluation and amplifies the ratings shown in the matrix, Table 3-1.

3.3.1 LUKE AFB, ARIZONA. The candidate sites associated with Luke AFB (1A, 1B & 2) meet the major technically oriented siting criteria, i.e., WESTPAC DSCS satellite visibility, minimum local obscura, minimum cloud cover and precipitation, and acceptable EMI/RFI from nearby sources. Other factors such as environmental impact and base supportability are also acceptable based on the evaluation standards.

3.3.1.1 There is concern associated with Site 1A suggested by recent problems of siting DOD RF systems. Although calculations indicate that the SOC antennas, present and future, included in the baseline satisfy current personnel safety standards, recent public and governmental interest in the potential hazards from radio emitters may cause these standards to be made much more stringent. For this reason, a significant reduction in the allowable safe exposure level was assumed for the environmental anlayses conducted for the site survey. Even with this reduction, the calculations indicate no hazard. The standards might be made drastically more restrictive than anticipated, however, or the public might become extremely sensitive to potential hazards. Given the congested area around the SAGE facility, particularly the hospital and family housing, more restrictive standards and/or heightened public concern might preclude siting the SOC baseline antennas, let alone future systems.

3.3.1.2 Site 1A has another problem associated with RF emissions. The AFSC/ASD Deputy for Engineering has calculated power densities and safe distances for all SOC antennas and found that peak power operation of the DSCS, Satellite Control and Data Relay System (SCDRS), and Data Link Terminal (DLT) antennas will exceed maximum levels for aircraft EEDs while in landing configuration. Since the antennas look across the traffic patterns, this could result in constraints on SOC and/or the base which may jeopardize their respective missions. This problem is discussed at length in Annex A.

3.3.1.3 Finally, Site 1A requires the acquisition of private property. Even so, its estimated cost is attractive. It should be noted, however, that the estimate for converting the SAGE facility is

Table 3-1 Site Evaluation Summary

	Luke Site 1A	Luke Site 1B	Luke Site 2	Nellis	Hill	Mountain Home	Malmstrom Site 1	Malmstrom Site 2	Kirtland	Buckley	Peterson
Adequate DSCS Satellite Visibility	■	■	■	■	□	■	□	□	□	□	□
Minimum Local Obscura	■	■	■	■	■	■	■	■	■	■	■
Mission Compatibility - EMI/RFI	■	■	■	X	■	■	■	■	■	X	■
Mission Compatibility - A/C Ops	X	□	□	X	X	X	X	X	■	X	■
Acceptable EMR Exposure	□	■	■	■	□	□	■	■	■	□	■
Minimum Natural Threats	□	□	■	■	X	■	■	■	■	■	■
Minimum Physical Threats	□	□	■	■	□	■	■	■	■	□	□
On Federal Property	X	□	□	■	■	■	■	■	■	■	■ X
Sufficient Acreage	□	□	■	■	■	■	□	■	■	□	■
Maximum Clear, Dry Weather	■	■	■	■	X	X	■	■	□	□	□
Electronic Threats	■	■	■	■	■	■	■	■	■	■	■
Additional Land Available	X	□	■	■	□	■	X	■	■	X	■
On/Near Active Base	■	■	■	■	■	■	■	■	■	■	■
Existing Facilities Available	■	■	X	X	X	X	■	□	□	X	X
Technical Personnel, Educational, etc., Facilities	■	■	■	■	■	X	□	□	■	■	■
Adequate Airline Service	■	■	■	■	■	X	X	X	■	■	■
Physical/Biological	■	■	■	■	■	■	■	■	■	■	■
Socioeconomic	■	■	■	■	■	X	■	■	■	■	■
Base Supportability	■	■	□	■	■	□	■	■	■	□	■
Site Facility Cost Impact	■	□	□	■	■	□	■	□	■	■	■

Key ■ = Meets requirement □ = Meets requirement with qualification X = Does not meet requirement

Table 3-1 Site Evaluation Summary (Continued)

	CHEYENNE SITE 1A	CHEYENNE SITE 1B	OFFUTT	DULUTH SITE 1	DULUTH SITE 2	HANCOCK
Adequate DSCS Satellite Visibility	☐	☐	X	X	X	X
Minimum Local Obscura	☐	■	■	■	■	■
Mission Compatibility - EMI/RFI	■	■	X	☐	☐	■
Mission Compatibility - A/C Ops	■	X	X	X	X	X
Acceptable EMP Exposure	■	☐	☐	■	■	☐
Minimum Natural Threats	☐	■	X	☐	☐	■
Minimum Physical Threats	☐	☐	☐	☐	■	☐
On Federal Property	X	☐	■	☐	■	■
Sufficient Acreage	X	X	☐	☐	■	☐
Maximum Clear, Dry Weather	☐	☐	X	X	X	X
Electronic Threats	■	■	■	X	X	X
Additional Land Available	X	X	X	X	■	X
On/Near Active Base	■	■	■	☐	☐	☐
Existing Facilities Available	☐	☐	X	■	X	■
Technical Personnel, Education, etc., Facilities	■	■	■	■	■	■
Adequate Airline Service	■	■	☐	X	X	☐
Physical/Biological	☐	■	■	■	■	☐
Socioeconomic	■	■	■	■	■	■
Base Supportability	■	■	■	X	X	X
Site Facility Cost Impact	X	X	■	■	☐	■

Key ■ = Meets requirement ☐ = Meets requirement with qualification X = Does not meet requirement

less accurate than the other costs for new construction. To refine the SAGE facility conversion estimates, an in-depth site survey and preliminary engineering design would have to be accomplished. The current estimate is based on required modifications readily identified during the initial survey; hence, the refined cost estimate would not be expected to be less. A more detailed analysis, however, may surface hidden costs not identified in the top-level survey nor included in the current estimate.

3.3.1.4 Site 1B eliminates the need to acquire private property and somewhat alleviates the RF emissions concerns associated with Site 1A. No hazard to personnel is presented because of the remote location of the SOC antennas, but incompatibilities with aircraft operations at Auxiliary Field No. 1 still exist. This is considered less of a problem than at the main base, for reasons discussed below under Site 2.

3.3.1.5 From an operational and security standpoint, Site 1B is at a disadvantage: the communications link between the main base and the remote antenna field introduces additional system elements and reduced reliability. In the SCDRS era, the long fiber optic communication systems, including repeater stations, are especially vulnerable to inadvertent or deliberate disruption. In most other respects, Site 1B is essentially equivalent to Site 1A. Its estimated costs are considerably higher, however, and indeed they exceed the estimates for Site 2.

3.3.1.6 Site 2 has advantage over most sites because of its remoteness and almost unlimited growth potential. There is a distinct advantage for the site in its low public profile and excellent security. Its remoteness introduces certain disadvantages: new roads, fire protection service, utilities, etc., would have to be provided, thus increasing the total cost as shown in Annex A. Even so, this site is not the most expensive due to favorable area cost factors. It is assumed that the State of Arizona will not be reluctant to return the site to Air Force ownership or continue to negotiate a reasonable yearly lease ($2500/year presently). A long term lease would be mandatory.

3.3.1.7 The limited aircraft operations at Site 2 imply a higher degree of mission compatibility than at Site 1A, primarily because it is believed that the potential incompatibilities have a low probability of occurring and are short term in nature.

3.3.1.8 It should be noted that there is a wide fluctuation among the candidate bases in utility costs, with Luke AFB being the most expensive. This is a significant factor for O&M funding. Initial installation of communications equipment is also expensive, but recurring costs are about the same as the other sites with the exception of Hill AFB.

3.3.2 NELLIS AFB, NEVADA. The candidate sites at Nellis AFB were quickly narrowed to one location in an area that provides good growth potential. Considering the major technical considerations for siting

SOC at Nellis AFB, electromagnetic compatibility is of major concern. A RF survey of the site has not been accomplished for this project; however, base interviews and review of the assigned frequencies indicate a high probability of mutual radio frequency interference. Also, due to the nature of the Tactical Fighter Weapons Center mission it is possible that future developments at Nellis or SOC would be seriously constrained by RFI problems.

3.3.2.1 Potential problems with aircraft safety exist at Nellis when the SOC has to operate in the peak power mode, in much the same manner as at Luke AFB, Site 1A. The air traffic density at Nellis fluctuates depending on whether an exercise is in progress. Traffic is generally moderate to high, and thus it is improbable that there would be a basis for negotiating an equitable solution to minimize the impact on the respective missions.

3.3.3 HILL AFB, UTAH. The candidate site at Hill AFB provides less-than-ideal growth potential. There is a warehouse complex to the south of the site. On the east and north, ordnance storage areas preclude development unless the storage areas are closed. The base boundary, railroad tracks, and a major highway lie to the west. Another potential problem exists with development of high rise complexes on public land about 1000-1200 feet to the west, although by land use agreements this problem could probably be solved.

3.3.3.1 Potential hazards to aircraft operations at Hill AFB are present when certain SOC antennas are radiating at peak power. The relative positions of the antenna field and the runway are quite similar at Nellis and Hill. The nature of the latter's mission might mean that the impact of this incompatibility is less severe, however.

3.3.3.2 Hill AFB weather profile indicates more impact to the SCIMS RF links than Luke or Nellis. Since weather observations and currently available data cannot provide a quantifiable answer to how much worse, the comparison is made only on a relative basis. An examination of the Probability of Cloud Free Line-of-Sight is included in Annex A.

3.3.3.3 The DSCS viewing angle, although less than 5°, is marginally acceptable at 4.15° due to the terrain factors discussed in Annex A.

3.3.4 MOUNTAIN HOME AFB, IDAHO. The three evaluation factors which stand out for Mountain Home AFB are the relatively poor weather profile, high total cost, and the relatively poor technical support base in the local community.

3.3.5 MALMSTROM AFB, MONTANA. DSCS visibility requirements will be met at Malmstrom AFB if WESTPAC is moved 5° east from its present location to 180° W longitude. This site has a potential technical deficiency nonetheless, because of the potential hazards to aircraft operations presented by SOC antenna systems. A limited technological base in the community and inadequate airline service also are deficiencies.

3.3.6 KIRTLAND AFB, NEW MEXICO. The selected site at Kirtland AFB meets all siting criteria for SOC, given a 5^{o} repositioning of WESTPAC. Estimated military construction cost at Kirtland AFB is lowest of all sites, excluding those with SAGE facilities. Utility costs are more moderate than at Luke AFB.

3.3.7 BUCKLEY ANGB, COLORADO. Buckley ANGB meets DSCS visibility requirements if WESTPAC is repositioned 7^{o} east, but a number of significant problems are associated with location of the SOC at Buckley. The most serious appears to be the mutual incompatibility of operations of the proposed SOC facility with that of existing antenna systems operated by the 2nd Communications Squadron (ADC). These latter systems employ individual S-band frequencies identical to those used by the SOC. While corrective measures can be taken to minimize this problem for SOC operations, it is not known what final adverse affect would result from the presence of the SOC.

3.3.7.1 In addition, the construction of the SOC facilities at the south end of the main runway at Buckley will present both an electromagnetic hazard to aircraft EEDs and a physical hazard to tactical and transient aircraft operations in the vicinity of the air field. Finally, continued expansion of the town of Aurora immediately adjacent to the base boundaries could result in potential EMR hazards to residents of newly constructed housing developments lying just beneath SOC antenna beam patterns.

3.3.8 PETERSON AFB, COLORADO. Acceptable DSCS visibility at Peterson AFB requires WESTPAC to be moved a minimum of 10 deg east from its present location, due to local terrain features. The only available site at Peterson is located between the approach to the present main north-south runway and the approach to a proposed new north-south runway. Since several SOC antenna beams are directed northward and southeasterly across these aircraft approach patterns, EMR power density levels hazardous to electroexplosive devices will be developed when the antennas are operated at peak power. Further, EMR hazards may result to commercial and residential developments near the site, which occupies a "peninsula" of land extending north from the base.

3.3.8.1 The site is bounded on the south by base housing, on the west by the main access road to the base, on the north by privately-owned commercial/industrial and residential land and on the east by city-owned land that is to serve as the approach area to the new runway for the municipal airport. From a security standpoint, thus, the Peterson AFB site offers little improvement over that at the current site. Finally, while this constrained site parcel is considered marginally adequate for construction of the initial SOC facility, there is an inherent limitation for future growth expansion because of the nearness to the proposed new runway and the encroachment of commercial and residential developments in areas adjacent to the site.

3.3.9 CHEYENNE MOUNTAIN COMPLEX, COLORADO (SITES 1A AND 1B). Acceptable DSCS visibility from Site 1A (Antenna on top of the mountain) requires a 7.5 deg WESTPAC DSCS shift to the east. Site 1B with the antennas located at Peterson AFB requires a 10 deg WESTPAC DSCS move to the east as discussed previously. Antenna site A at the top of the Cheyenne Mountain is privately owned and presently occupied by three commercial broadcast towers. Removal of the towers would be required to provide enough space for DSCS, SCDRS, and DLT antennas. Future growth would be very difficult to accomplish due to the extremely rough, rocky terrain. In addition to the problems discussed in paragraph 3.2.9.8 for antennas located at Peterson AFB, the communications links to the facilities at Cheyenne Mountain Complex would be highly vulnerable to intentional or accidental disruption. The existing facilities at Cheyenne Mountain are not large enough to accommodate SOC systems and personnel that must be contiguously located to perform the AFSCF mission. This applies even assuming that all existing space would be made available, an assumption which is considered unrealistic.

3.3.9.1 The expansion of these spaces in the interior of the mountain would be extremely costly. When the possibility of collocating with SOC additional activities such as SOPC is considered, the inadequacy of the existing space is even more evident. Finally, the antennas in their radomes located along the crest of Cheyenne Mountain, if site 1A is chosen, would be highly visible throughout the Colorado Springs/Fort Carson area. This would make it very difficult for the facility to maintain a low profile. It might also be considered an adverse environmental impact on the esthetic qualities of an unusually scenic area.

3.3.10 OFFUTT AIR FORCE BASE, NEBRASKA. WESTPAC DSCS would have to be relocated 17 deg to the east in order to provide a minimum 5 deg visibility at Offutt AFB. The land available for the site is insufficient for future growth. Antenna emissions could disrupt testing and calibration activities conducted in support of the 55th Strategic Reconnaissance Wing. Radiation hazards would be presented to aircraft operations at the base. The planned high data rate communications for the future SOC would be disrupted by the high humidity and considerable cloud cover characteristic of Offutt AFB weather. The area is susceptible to devastating tornados. The proposed site is located along the east boundary of the base, near the Missouri River and the city of Bellevue. As a result, it is subject to flooding and affords less than satisfactory perimeter security. Potential EMR hazards are posed to city residents. Airline service to the West Coast is infrequent.

3.3.11 DULUTH INTERNATIONAL AIRPORT, MINNESOTA (SITES 1 AND 2). WESTPAC DSCS visibility at Duluth IAP cannot be achieved with any reasonable repositioning of the satellite (it would require a 22.8 deg move to the east). Numerous other problems exist at Duluth IAP with respect to siting the SOC. Peak power antenna radiation is hazardous to military aircraft operated by the 148th TRG (ANG). Electronic threats such as jamming and eavesdropping are presented by foreign power vessels docked in the local harbor. Heavy cloud cover and precipitation are

typical, precluding growth to very high frequency satellite communications links. Airline service to the West Coast is inadequate to support the rapid responses sometimes demanded by satellite control operations. The existing SAGE area (Site 1) is located on a tiny parcel of base owned property, surrounded by city and private property. There is no room for SOC growth at the SAGE site.

3.3.11.1 A programmed change to the 148th TRG mission would introduce EMI/RFI problems caused by SOC antennas. Perimeter security is poor at Site 1 because of its small size and location adjacent to a major public highway, U.S. 53. Finally, the AFSCF might be required to assume the host base role because of the size of the SOC project with respect to the remainder of the base.

3.3.12 HANCOCK FIELD, NEW YORK. WESTPAC DSCS is not visible from Hancock Field. This precludes single-hop communications with the Guam Tracking Station (GTS), because WESTPAC is the only existing DSCS visible to GTS.

3.3.12.1 An additional problem caused by the inability to use WESTPAC DSCS at Hancock is that the initial hop of a multiple hop from SOC to GTS must be routed either via the ATLANTIC DSCS or via EASTPAC DSCS. Either way, scarce DSCS channel capacity is used on one or the other of the two most heavily loaded DSCS satellites. Unique among the sites surveyed, Hancock Field can view the ATLANTIC DSCS. This permits one-hop communications with single RTSs in England and the Indian Ocean. This advantage partially alleviates the inability to use WESTPAC DSCS. On balance, however, Hancock Field cannot be considered a satisfactory SOC site from a DSCS communication standpoint.

3.3.12.2 SOC antenna beams operating across the Hancock Field runways would present a radiation hazard to aircraft EED's. Potential EMR hazards, to which the public is becoming increasingly sensitive, are posed by an antenna field in the middle of a small base. Electronic jamming and eavesdropping threats are presented by foreign ships operating in Lake Ontario. Persistent cloud cover, heavy precipitation, and high humidity surrounding the Hancock Field region are detrimental to a growth capability for future high rate communications. Future expansion of the proposed site is limited because of the constraints presented by nearness of airport runways, private land boundaries and nearby swamplands. Finally, as in Duluth, the AFSCF might be required to assume the host base functions with their attendant costs.

3.3.13 Site Survey 78-21 Conclusions: Using the results of this survey, Malmstrom, Peterson, and Kirtland Air Force Bases were selected as the final candidate sites best meeting the criteria. Malmstrom was chosen on the basis that existing facilities could provide a savings in military construction cost and that technical workarounds

were possible for compatibility with operations. Similarly, the availability of state and private land in the Colorado Springs area makes the Peterson site favorable by eliminating deficiencies related to the limited and restricted location of antenna systems. Kirtland AFB was selected because it had only minor deficiencies.

3.4 Site Survey 79-26.

3.4.1 Findings: Each site was evaluated (Table 3-2) against the previously established criteria. Added emphasis was given to evaluating each location's ability to assume the base operating support responsibilities of the CSOC mission. Additionally, an informal environmental analysis was performed at each location and existing available facilities were identified to decrease new construction costs. The following paragraphs highlight the significant findings of the survey (Annex B).

3.4.1.1 MALMSTROM AFB, MONTANA. The primary advantages offered by Malmstrom are the use of existing facilities, its ability to absorb future missions, and its environmentally preferred location. Due to the inactivation of existing ADCOM and NORAD units, the SAGE facility (Bldg 500) can be effectively used for CSOC Engineering and Administration requirements, but a new technical facility would be required. Additionally, the inactivation also allows the Malmstrom base operating support functions to assume CSOC mission requirements with little to no facility impact. However, these advantages are offset by high area construction cost factors making Malmstrom the highest in facility costs of the three sites (Annex B, Appendix B). The initial estimated military construction cost is approximately $80M (FY 78$). Although the antenna location represents no EMR hazard to aircraft or missile EED units under normal operating power levels, at planned power levels, future antenna systems may produce an EED hazard zone which violates the runway air traffic safety zone.

3.4.1.2 PETERSON AFB, COLORADO. The primary advantage offered by Peterson is the modern base operating support facilities. However, because of the lack of available existing facilities, the CSOC would be an entirely new facility. Additionally, acreage must be acquired east of Peterson in order to meet the CSOC requirements. Except for 10,000 SF of possible CSOC storage located at Peterson AFB, the entire CSOC facility would be located east of the base on non-Federal land. Including land acquisition, Peterson would have the second highest initial estimated military construction costs at approximately $78M.

3.4.1.3 KIRTLAND AFB, NEW MEXICO. Kirtland AFB offers the use of available existing facilities and is the most geographically secure site. The Manzano area of Kirtland has (seven) unused buildings that can be used for CSOC Engineering and Administration requirements. A new technical building would have to be constructed and the antenna system would be located remote from the CSOC facility. The use of existing

Table 3-2 Site Survey 79-26

SITE	CRITERION / INTERIOR CONUS	EMR HAZARD	RF QUIET	OBSCURA	NATURAL DISASTER	ACREAGE	MILITARY BASE	WX ATTENUATION	PHYSICAL THREAT	EXPANSION	FEDERAL PROP	TRANSPORTATION	DSCS WESTPAC	TDRSS	TECH SPT BASE FACILITIES
MALMSTROM AFB	■	X	■	■	■	■	■	■	■	■	■	□	□	X	□	■
COLORADO SPRINGS/ PETERSON AFB	■	■	■	■	■	■	■	■	■	■	□	■	□	X	■	■
KIRTLAND AFB	■	■	X	X	■	■	■	■	■	■	■	■	□	■	■	■

■ = MEETS CRITERION
□ = SOME IMPACT
X = POTENTIAL IMPACT FOR FUTURE SYSTEMS

facilities coupled with the lowest area construction cost factor makes Kirtland the lowest initial estimated facility costs of the three candidate sites, approximately $68M. The principal disadvantage is that the Sandia and Manzano mountains present marginal viewing conditions to the east for baseline CSOC antenna systems and violate the 5 degree minimum elevation angle for planned CSOC antenna systems in small portions of the north, east, and west horizon.

3.4.2 Site Survey 79-26 Conclusions:

3.4.2.1 There does not appear to be any significant impact on each of the candidate sites ability to absorb the Base Operating Support (BOS) responsibilities of the CSOC requirements. Malmstrom, however, would have a slight BOS advantage over the other candidate sites because of the loss of several existing units.

3.4.2.2 No major environmental problems were identified for each of the proposed locations during the preliminary assessment.

3.4.2.3 Both Kirtland and Malmstrom offer a significant amount of existing facilities for CSOC use with Peterson having only a small amount available.

3.4.2.4 From a CSOC baseline technical standpoint, there appears to be no overriding reason to choose one location over another. If however, possible future CSOC missions are considered, then Malmstrom has a potential EED problem and Kirtland has a potential obscura problem.

3.4.2.5 Based only on initial estimated military construction cost, and not considering operational and organizational factors, Kirtland AFB shows an advantage over Peterson and Malmstrom AFB's respectively.

3.5 Operational and Organizational Factors:

3.5.1 Introduction: Site surveys 78-21 and 79-26 evaluated each of the candidate sites against technical and environmental criteria, construction cost, facility usage and base operating support. Not considered in the initial surveys were operational and organizational factors which are site dependent and which effect the efficiency, effectiveness and life-cycle costs of the Consolidated Space Operations Center (CSOC). Consequently, the operational and organizational advantages/disadvantages of locating the CSOC at each of the candidate sites were evaluated, specifically the effects resulting from the geographical proximity of the CSOC with the Space Defense Operations Center (SPADOC).

3.5.2 Background: The SPADOC located in the Cheyenne Mountain Complex (CMC) (in the Colorado Springs area) became operational on 1 Oct 79. The SPADOC will evolve into the command, control, and communications center for space defense for the U.S., interfacing with DOD, national and civil space systems. As such, its mission is threefold: surveillance of space activities to identify abnormal or hostile events;

warning of hostile acts against US space assets and poentially, command and control of US ASAT assets. Performance of the first two tasks requires close coordination with US spacecraft operators. Identification of hostile or abnormal space activities requires current knowledge of space activities, both US and foreign. Active and close coordination between SPADOC and the CSOC (which with its companion, the Satellite Test Center, operates 80% of the DOD spacecraft) will provide a substantial source of input data to the SPADOC on planned and in-progress US military and space operations. It is the nature of this intimate relationship between CSOC and SPADOC and the similarities of the space operations functions that are conducted at these facilities that operational and organizational advantages accrue from their geographical proximity, and which must be weighed in an evaluation of a site for CSOC.

3.5.3 Operational. Among the operational advantages are the increases in efficiency and effectiveness, and life-cycle cost reductions that could be achieved through geographical proximity. Several examples are described which are illustrative of the kind of potential savings available and are described in detail in Annex C. A 10 year life-cycle is used for CSOC for estimating purposes only.

3.5.3.1 Efficiencies:

3.5.3.1.1 The first of these efficiencies can be achieved through the sharing of technical support facilities, due to the geographical proximity of CSOC to the CMC. A communications terminal is currently programmed for installation in 1982 in the Colorado Springs area for support of the CMC. The CSOC configuration also requires such a terminal for communication with the Remote Tracking Stations (RTS's). Locating the CSOC in the Colorado Springs area eliminates the need for a CSOC terminal, avoiding military construction and hardware acquisitions cost, as well as. the recurring cost of military manpower and O&M cost. Both Kirtland AFB and Malmstrom AFB do not have and are not programmed to have such a terminal. Potential cost avoidance available through the sharing of the terminal with CSOC is approximately $13M over a 10 year life cycle in FY 79 dollars.

3.5.3.1.2 A second example results from the centralization of scarce military manpower resources. Siting the CSOC in the Colorado Springs area will allow access to the existing blue suit space operations manpower pool (51XX, 20XX, 27XX, 28XX, 511X0), resident in HQ ADCOM at Peterson AFB and the CMC, providing the potential for manpower savings. No equivalent technical support base exists at Malmstrom. A comparable technical support base exists at Kirtland but it is oriented toward physics research (lasers, weapons effect) not space operations. Through the optimizations of this manpower pool with that required for CSOC, unnecessary duplication could be avoided. The level of savings could vary widely dependent upon the degree of consolidation of like

functions and is contingent upon command agreements. Recognizing that the personnel packages for SPADOC and CSOC have not been completed, the example cited estimates only the possible savings of computer-oriented and other management overhead personnel between 10-24 blue suit positions. This is possible because computer system and software (orbital mechanics algorithms) requirements are similar and in many cases computational routines will be identical. Potential ten year life cycle cost savings are between $2.1M and 5.2M (FY 79$).

3.5.3.1.3 Other efficiencies can be accumulated in the area of O&M cost avoidance. Several examples, illustrated in Annex B, cover cost avoidance items resulting from reduced personnel relocation costs, reduced travel costs, and reduced training costs. The potential cumulative cost avoidance in the O&M area (FY 79$) over a ten year life-cycle amounts from 1.4M to 1.6M dollars.

3.5.3.2 Effectiveness: The operational advantages accruing from geographical proximity of CSOC to SPADOC which increase effectiveness are not as quantifiable as those advantages previously discussed. The CSOC Management Concept requirement for close coordination between the SPADOC and CSOC for integrated operational planning and day-to-day operations, based on their interdependence and interrelationships, is enhanced by a CSOC located at Peterson rather than Kirtland or Malmstrom. Coordination time is minimized while decision and reaction time is optimized, avoiding costs due to false starts and lost time.

3.5.3.2.1 For example, false starts and lost time represent a decrease in effectiveness in trying to establish and/or alter operational interfaces via TDY contacts. SPADOC operations will require substantial contact between SPADOC and CSOC. Attempting to maintain contact via TDY trips is limiting (infrequent and necessarily limited in number of personnel traveling). Geographical proximity facilitates worker level contact for immediate problem resolution.

3.5.3.2.2 Many of the requirements which drive the design of the CSOC are inherently the same as those for the SPADOC. The computer system and software (orbital mechanics algorithms) requirement are similar and in many cases computational routines will be identical. Additionally, the requirement for CSOC interfaces with NMCC, WWMCCS and space/ space-related activities would be simplified due to the presence of these existing interfaces in the SPADOC. In general, the opportunity to improve the management of resources, the facilitated operations planning, and coordination will lead to improved CSOC/SPADOC interfaces resulting in time-compressed decisionmaking and improved space order of battle.

3.5.4 Organizational: By the mid-80s the Air Force will have a fully operational SPADOC within the CMC, and CSOC, which with all its planned elements, will be a "de facto" command and control center for military space operations. Unfortunately, because of acquisition lead times, a decision must be made now on CSOC, while being careful not to foreclose future organizational options that could enhance effectiveness/

efficiency of space systems and space operations later in the next decade. Therefore, the CSOC location must be made in light of future organizational options. Geographical proximity of CSOC and SPADOC preserves future organizational options - allowing the unification or further consolidation of space operations responsibility without the attendant relocation costs.

3.5.4.1 Geographical proximity also offers other advantages. There is historical precedent within the Air Force for centers of technical excellence. For example, military aeronautical development activities have centered around Wright-Patterson Air Force Base. From this, then, the opportunity for establishing a military center for space operations is presented in the location of CSOC in the geographical proximity of SPADOC.

3.5.5 Summary: The location of CSOC goes beyond the analysis of the technical, environment, base operating support, MCP cost and facility utilization factors. Although communications technology could provide a measure of connectivity between SPADOC and CSOC from any of the proposed locations, the operational and organizational benefits favor selecting Peterson AFB/Colorado Springs area. Operational factors, including preserving growth and organizational options, weigh heavily on the final decision. As has been shown in the illustrative examples, the life cycle costs easily amortize the differential in the initial estimated MCP costs. Over the life of the CSOC facility, which will be well in excess of 10 years, the cost savings from these examples alone will be substantial. Including the additional MCP and land acquisition cost required to place the CSOC in the Peterson AFB/Colorado Springs area vice Kirtland AFB, NM, net life cycle savings will be approximately $7 million. Added to these increases in efficiencies are those advantages which increase the effectiveness of space operations. Although not as easily quantified, these advantages, together with the organizational advantages substantially favor Peterson AFB/Colorado Springs area for location of the CSOC.

3.6 Conclusion: Based on the foregoing evaluations, Peterson AFB/Colorado Springs area was selected as the preferred site for location of the CSOC pending completion of the Environmental Impact Analysis Process. The Peterson AFB/Colorado Springs location provides the opportunity to link space defense and space operations activities. Future operations in space will be significantly improved by closely integrating the control of space assets with the means to protect them, while decreasing life cycle costs and increasing the effectiveness of these operations. In addition, the Peterson AFB/Colorado Springs area meets all EMI/RFI and obscura criteria without costly workarounds and adds flexibility and growth potential for future space operations.

ANNEX A

SUMMARY OF INITIAL SITE SURVEY 78-21

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LIST OF ILLUSTRATIONS

SECTION I - DESCRIPTION OF CANDIDATE SITES

This section identifies the base mission and geographic location of each of the initial twelve candidate bases and fifteen facility sites on those bases for potentially locating STC II. The twelve bases are all located in the continental United States as shown on the map in Figure 1-1. The following is a summary of the sites and options considered:

Base	Site	Ref. Fig.
Luke AFB	Site 1 (SAGE Buildings)	Fig. 1-2
	Alternative A - Collocated Antenna Field	
	Alternative B - Remote Antenna Field (Aux 1)	
	Alternative C - Remote Antenna Field (TBD Location)	
	Site 2 (All Facilities at Auxiliary Field 1)	Fig. 1-3
Nellis AFB	Site 1 (East of Base)	Fig. 1-4
Hill AFB	Site 1 (West Side of Base)	Fig. 1-5
Mtn. Home AFB	Site 1 (NE Corner of Base)	Fig. 1-6
Malmstrom AFB	Site 1 (SAGE Building/Antennas at Site 2)	Fig. 1-7
	Site 2 (All Facilities in South Portion of Base)	Fig. 1-7
Kirtland AFB	Site 1 (SE Corner of Base)	Fig. 1-8 & 1-9
Buckley ANGB	Site 1 (SW Corner of Base)	Fig. 1-10
Peterson AFB	Site 1 (NE Portion of Base)	Fig. 1-11
Cheyenne Mtn Complex	Site 1A (Existing buildings with antennas located on top of mountain)	Fig. 1-12 & 1-13
	Site 1B (Existing buildings with antennas located at Peterson AFB)	Fig. 1-11 & 1-12

	Site	Ref. Fig.
Offutt AFB	Site 1 (SE Portion of Base)	Fig. 1-14
Duluth International Airport	Site 1 (SAGE Buildings/Antennas at Site 2)	Fig. 1-15
	Site 2 (All Facilities in North Portion of Base)	Fig. 1-15
Hancock Field	Site 1 (SAGE Buildings/Antenna Field Adjacent)	Fig. 1-16

Technical considerations, security, and accessibility to satellite Systems Progrm Offices (SPOs) and STC I were the major considerations in siting STC II within the 48 contiguous states. For example, Hawaii was eliminated because of electronic threats to communications and because accessibility to STC I and SPOs was poor. Alaska was eliminated because of poor accessibility and because the far northern latitudes would have a significant impact on look angles for geosynchronous satellites. In addition, weather would have a deleterious effect on future programs with data rates requiring K-band and laser frequencies.

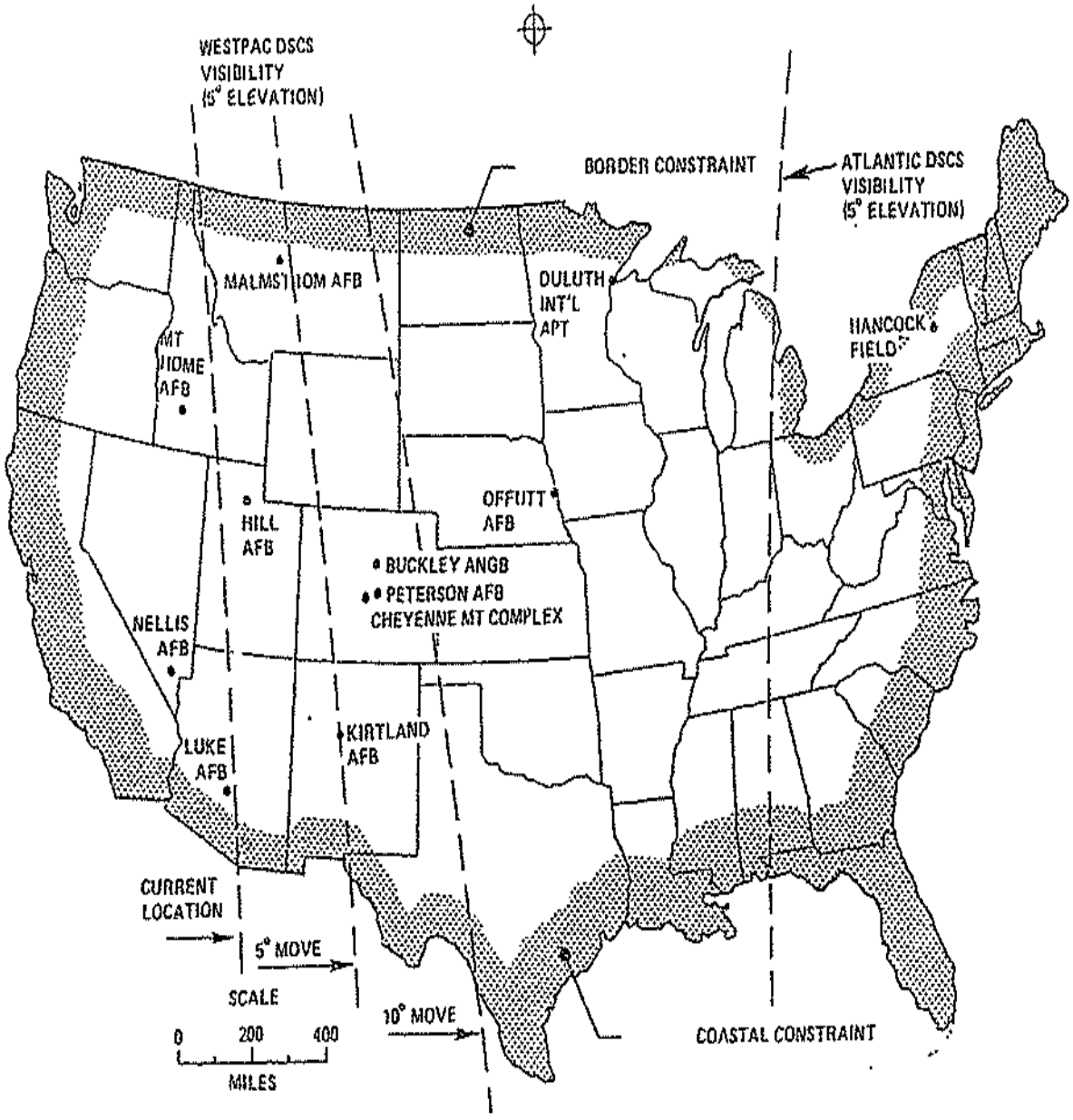

Figure 1-1 Location of Twelve Candidate Air Force Facilities

1.1 LUKE AIR FORCE BASE, ARIZONA (Tactical Air Command). Luke AFB is the largest fighter training base in the free world. Operations are under the direction of Headquarters, Tactical Training. The 58th Tactical Training Wing conducts USAF combat crew training in the F-4 and F-15. West German students are trained in the F-104G. Headquarters for the 26th Air Division (Aerospace Defense Command) and SAGE Region Control Center (North American Air Defense Command) are also located at Luke.

1.1.1 The base is located in the south central portion of Arizona about 20 miles west northwest of the city of Phoenix. Two sites associated with land utilized by the base were considered for the main STC II facility. The first (Site 1) was located on Air Force property in the northeast portion of Luke AFB proper, to the east of Litchfield Road. As shown in Figure 1-2, this site contains a NORAD "SAGE" facility consisting of several buildings, including a large central building and associated power plant. The base main gate is located about one block south of the SAGE facility entrance. Other base buildings are located south of the facility, including a hospital and base exchange building. Base housing is located immediately to the east of the facility.

1.1.2 The northern base boundary near the SAGE facility is bordered by privately owned farmland. Additional land (85 acres) for the antenna field and safety buffer zone would have to be acquired to the north for Alternative A, i.e., the collocated antenna field.

1.1.3 Litchfield Road, connecting Buckeye Road (7 miles south) and U.S. Highway 60/89 (6 miles north), is immediately adjacent to the SAGE facility and separates it from the airfield. Traffic is very heavy during shift changes since the road is used as the primary departure route to the north. This county highway is also used for north/south travel between small agricultural communities in the area. U.S. Interstate 10, currently under construction nearby, will run in an east/west direction between Phoenix and Los Angeles. It will cross Litchfield Road about three miles south of Luke AFB. The Phoenix International Airport (Sky Harbor) is approximately 27 miles to the southeast of the base.

1.1.4 Alternative arrangements using the SAGE buildings for the main STC II facility but locating the antenna field elsewhere were considered. The first possibility examined was placing the antenna field in the northwest corner of the base. Additional study of the operational characteristics of the location excluded this possibility from further consideration. Operational problems with this site include (1) the proximity of antennas to the runway, causing electromagnetic radiation impact on aircraft, and (2) the obscura which the STC II antennas would present to a ground control radar antenna nearby. Moving the antennas closer to the base boundary would increase the distance from the runway, but would require acquisition of public land to accommodate the antenna safety buffer zone. This would defeat the original rationale for considering this location for the remote antenna field.

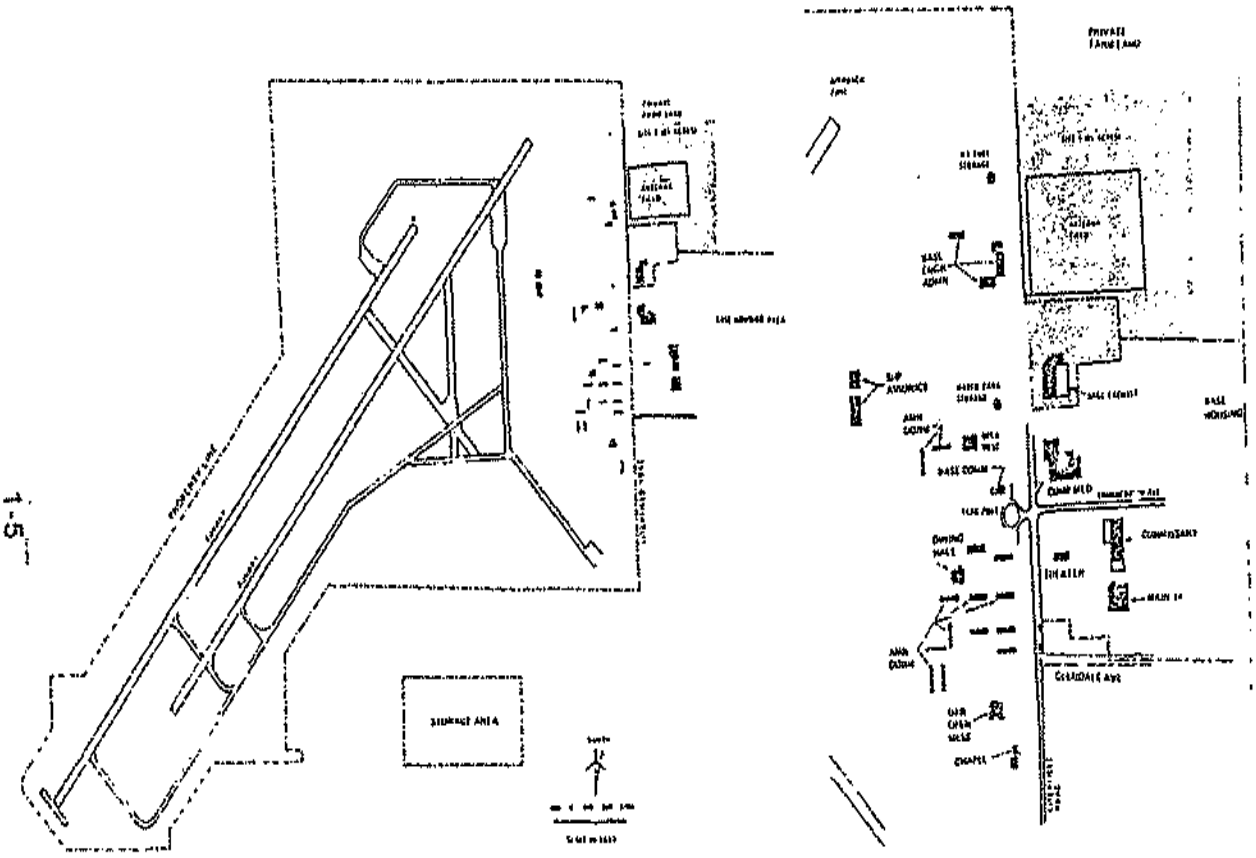

Figure 1-2 Luke Air Force Base - Site 1 (Sage Facility)

1.1.5 Another possibility is to locate the remote antenna field for STC II at Luke AFB Auxiliary Field No. 1 (Aux 1). Technical analyses conducted subsequent to the survey established the feasibility of this approach, which has been designated Alternative B.

1.1.6 The third possibility for Site 1 is to place the remote antenna field at a TBD location relatively close to the main base, i.e., within approximately four miles of the SAGE facility. (This distance is based on technical considertions involving fiber optic communicaation links.) Potentially, the third possibility, Alternative C, eliminates any acquisition of public land and avoids any interference with aircraft operations. In these respects, it would be superior to both Alternative A and B.

1.1.7 The three antenna field alternatives for Site 1 at Luke AFB are addressed in greater detail later in the report. Where it is necessary to distinguish among them, they are referred to as Site 1A, Site 1B, and Site 1C, respectively. Where the discussion applies equally to all three, on the other hand, the report uses the term "Site 1."

1.1.8 The second site at Luke AFB (Site 2) consists of 60 acres, 22 road miles northwest of the main base at Auxiliary Field No. 1 (Aux 1). The site layout is the standard rectangular configuration. Figure 1-3 shows the specific location of this site in the Aux 1 area and the relationship of the site to the main base, the city of Glendale and the city of Phoenix. Site 2 is reached by a four-mile unpaved access road off U.S. Highway 60/89. The route from this site to Luke AFB is southeast via Highway 60/89 and then south on Litchfield Road. Phoenix is reached via any of several major east/west roads such as Northern Avenue, Bethany Home Road, Indian School Road, or Buckeye Road.

1.1.9 Site 2 is located on land which is currently owned by the state of Arizona and leased by the Air Force. It is surrounded by land which is now devoid of any ground operations. Aux 1 is used by both Luke and nearby Williams AFB for extensive instrument approach training. No actual landings are conducted because of the poor condition of the runway.

1.2 NELLIS AIR FORCE BASE, NEVADA (Tactical Air Command. The host unit at Nellis AFB is the 57th Tactical Training Wing. Nellis is also home for the USAF Tactical Fighter Weapons Center, the 474th Tactical Fighter Wing, the 4440th Tactical Fighter Training Group, and the Thunderbirds Air Demonstration Squadron. Operation Red Flag, a realistic combat training exercise for Department of Defense aircrews, is conducted at Nellis on a regular basis.

1.2.1 Nellis AFB is located in southeast Nevada approximately 10 miles northeast of the City of Las Vegas, with access directly off Las Vegas Boulevard (U.S. 91/93). East/west crossroads near the base connect Las Vegas Boulevard to U.S. Interstate 15 which runs in a northeast direction approximately 2 miles northwest of the base. McCarran International Airport at Las Vegas is about 18 miles southwest of the base. Figure 1-4 shows the location of the

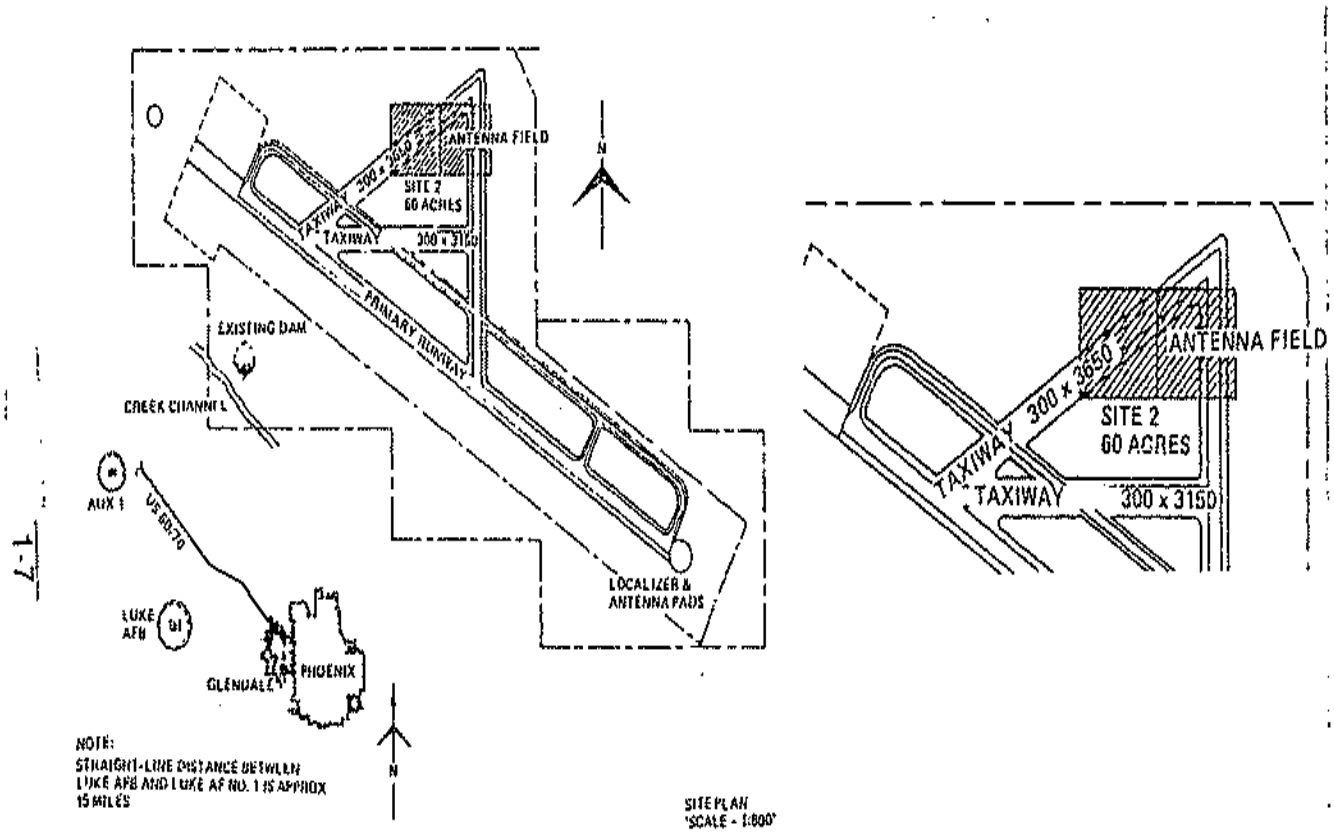

Figure 1-3 Luke Air Force Base - Site 2 (Auxiliary Field No. 1)

site in "Area No. 2" on Nellis AFB, and depicts the relationship of this area to the main portion of the base including the runway operations. The site consists of 60 acres with a standard layout. An east/west road (Obannon Road) connects the main base with Area No. 2 via an unpaved access road approximately 800 feet in length. Approximately one-quarter mile to the east of the site Obannon Road joins Forrestal Drive, which runs in a northwest direction and connects with U.S. 91/93 at a distance of about 2 miles.

1.3 HILL AIR FORCE BASE, UTAH. (Air Force Logistics Command). Hill AFB is Headquarters for the Ogden Air Logistics Center which furnished logistics support for Minuteman and Titan ICBMs and is the manager for F-4, F-101, and F-16 aircraft. Flying units assigned to Hill are the 388th Tactical Fighter wing and the 508th Tactical Fighter Group (Air Force Reserve).

1.3.1 Hill AFB is located in the northern portion of Utah just east of the Great Salt Lake between Salt Lake City and Ogden, Utah. These cities are located 30 miles to the south and 7 miles to the north of the base, respectively. The communities of Roy and Clearfield are near the eastern boundary and Layton and Kaysville are a few miles south of the base. U.S. Intersate 15 runs along the western boundary of the base and several gates access the base from the highway as shown in Figure 1-5. The Union Pacific Railroad line runs between U.S. Interstate 15 and the western boundary of the base. U.S. Highway 89 runs north/south about 2 miles east of the base. The most direct access to the site is by the Sunset Gate marked in the figure. Air Travel from Ogden/Salt Lake City area is provided by the Salt Lake International Airport, located about 28 miles south of the base and a few miles west of U.S. Interstate 15.

1.3.2 On Hill AFB the proposed site is located at the intersection of Second Street (north/south) and Georgia Street (east/west), which can be reached by Sixth Street immediately upon entering the Sunset Gate. There is no usage to the west other than a base railroad spur. An ordance storage and test area is located about 1/2 mile from the site. Officer family housing is located directly to the southwest; immediately to the southeast several base buildings are occupied by the Ogden Air Logistics Center as enginering and administrative offices. Most of the land to the east is free from current active usage. The site is not of the standard rectangular layout due to constraints of local roads and rail lines on base.

1.4 MOUNTAIN HOME AIR FORCE BASE, IDAHO (Tactical Air Command). Mountain Home AFB is home of the 366th Tactical Fighter Wing which conducts flying operations and training in the F-111.

1.4.1 The base is located in the southwestern section of Idaho. It is approximately 56 miles southeast of Boise and 10 miles west/southwest of Mountain Home, Idaho. Boise and Mountain Home are both adjacent to U.S. Interstate 80N. The road from Mountain Home to Mountain Home AFB (State Highway 67) terminates at the base main gate. The site consists of the standard 60-acre configuration and is located in an area immediately east of

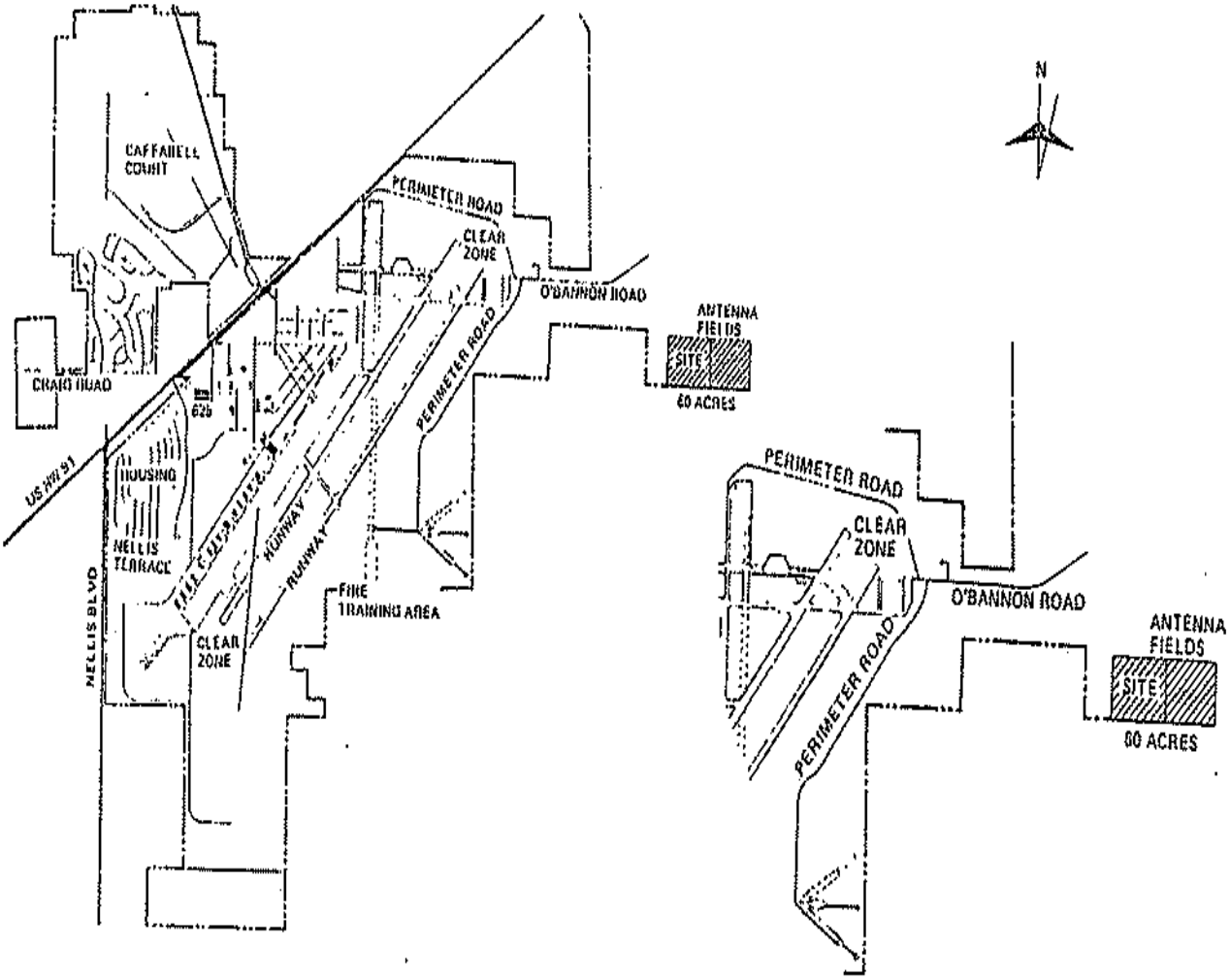

Figure 1-4 Nellis Air Force Base

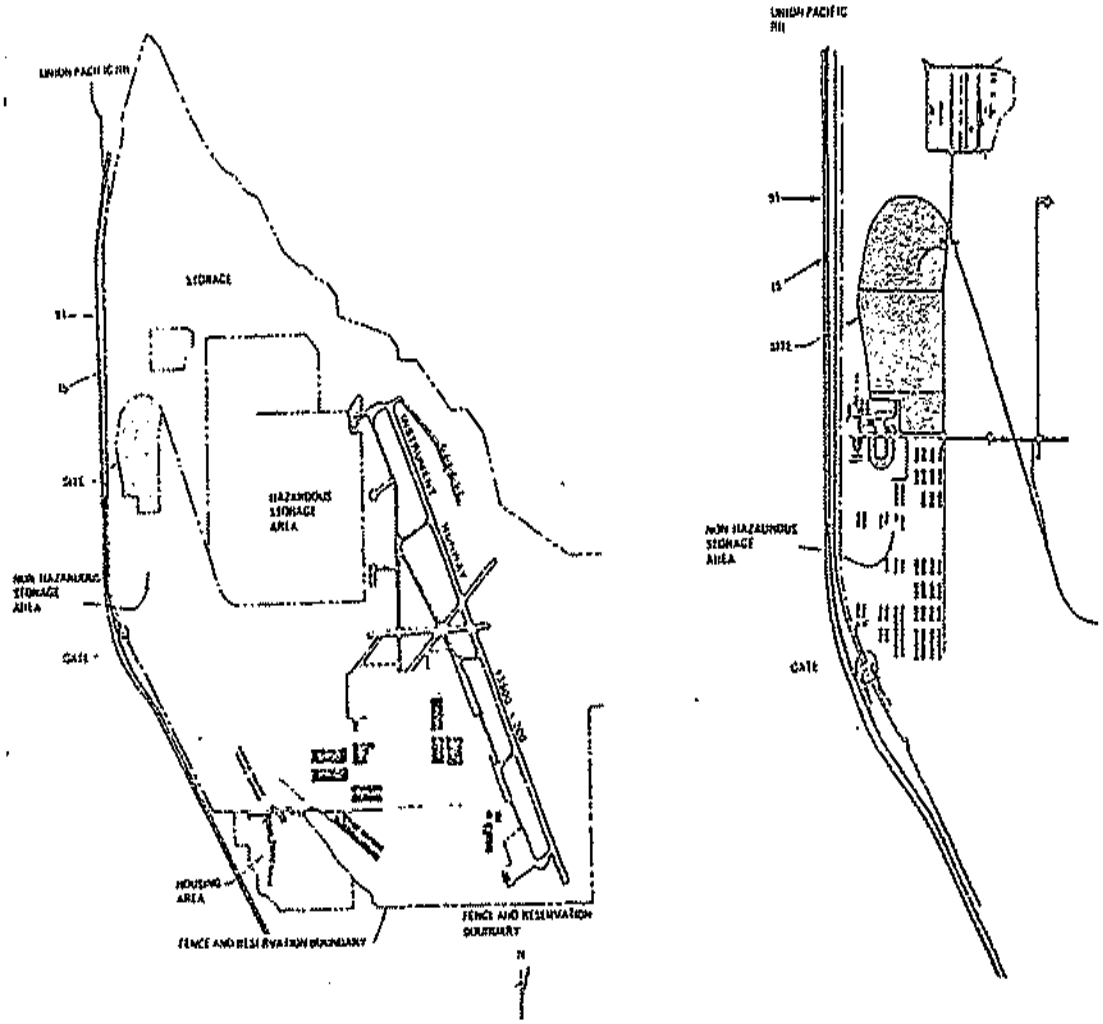

Figure 1-5 Hill Air Force base

the Main Street as shown in Figure 1-6. Access to the site will be from Main Street, inside the gate. Base housing lies to the south of the site, while land to the east and north along the base boundaries is farmland which is privately owned. Air travel from this area is from Boise at Gowan Field Municipal Airport.

1.5 MALMSTROM AIR FORCE BASE, MONTANA (Strategic Air Command). The 341st Strategic Missile Wing is the host unit at Malmstrom AFB. Other major units assigned to the base are Headquarters 24th Air Division (Aerospace Defense Command) and the SAGE Region Control Center (North American Air Defense Command).

1.5.1 Malmstrom AFB is located in the northwestern sector of Montana 4 miles east of Great Falls, Montana. Great Falls is located st the intersection of U.S. Highway 89 and U.S. Interstate 15. The main gate of the base if reached by traveling east on Second Street from Great Falls. Figure 1-7 depicts the section of the base containing the main gate and the two sites, Site 1 and Site 2. Site 1 consists of an existing "SAGE" facility very similar to that at Luke AFB. It is located at the intersection of Second Street and Avenue K and if selected, the antenna portion of the site would be located at Site 2. Site 2 is located almost due south of the center of the base near the southern boundary. It is located about 3,500 feet southeast of the runway and must be reached by a perimeter road which is paved for about half of its length. Site 2 is about 1,600 feet north of U.S. highway 89 and would be the standard 60 acre layout. There is a potential for gate access adjacent to the site on the southern base boundary. The Great Falls International Airport about 5 miles west of the base provides air travel facilities for this area of Montana.

1.6 KIRTLAND AIR FORCE BASE, NEW MEXICO (Military Airlift Command). Kirtland AFB is located adjacent to Albuquerque on the south side of the city. It is bounded on the East by National Forest Lands, on the South by the Isleta Indian Reservation, and on the North and West by the City of Albuquerque. The base is comprised of some 54,000 acres and is host to a wide variety of tenants (both military and Federal government tenants).

1.6.1 The host organization at Kirtland AFB is the 1606th Air Base Wing. Major agencies and units include AF Contract Management Division (AFSC); AF Test and Evaluation Center; AF Weapons Laboratory (AFSC); New Mexicon Air National Guard; 1550th Aircrew Training and Test Wing (MAC); Defense Nuclear Agency Field Command; Naval Weapons Evaluation Facility; Sandia Laboratories; Lovelace Biomedical and Environmental Research Institute; Department of Energy's Albuquerque Operations Office; AFSC NCO Academy; AF Directorate of Nulcear Surety; 1960th Communications Squadron, and 3908th Aviation Depot Squadron. These agencies furnish contract management; nuclear and laser research, development, and testing; operational test management; nuclear and laser research, development, and testing; operational test and evaluation services; advanced helicopter training; and HC-130 search and rescue training.

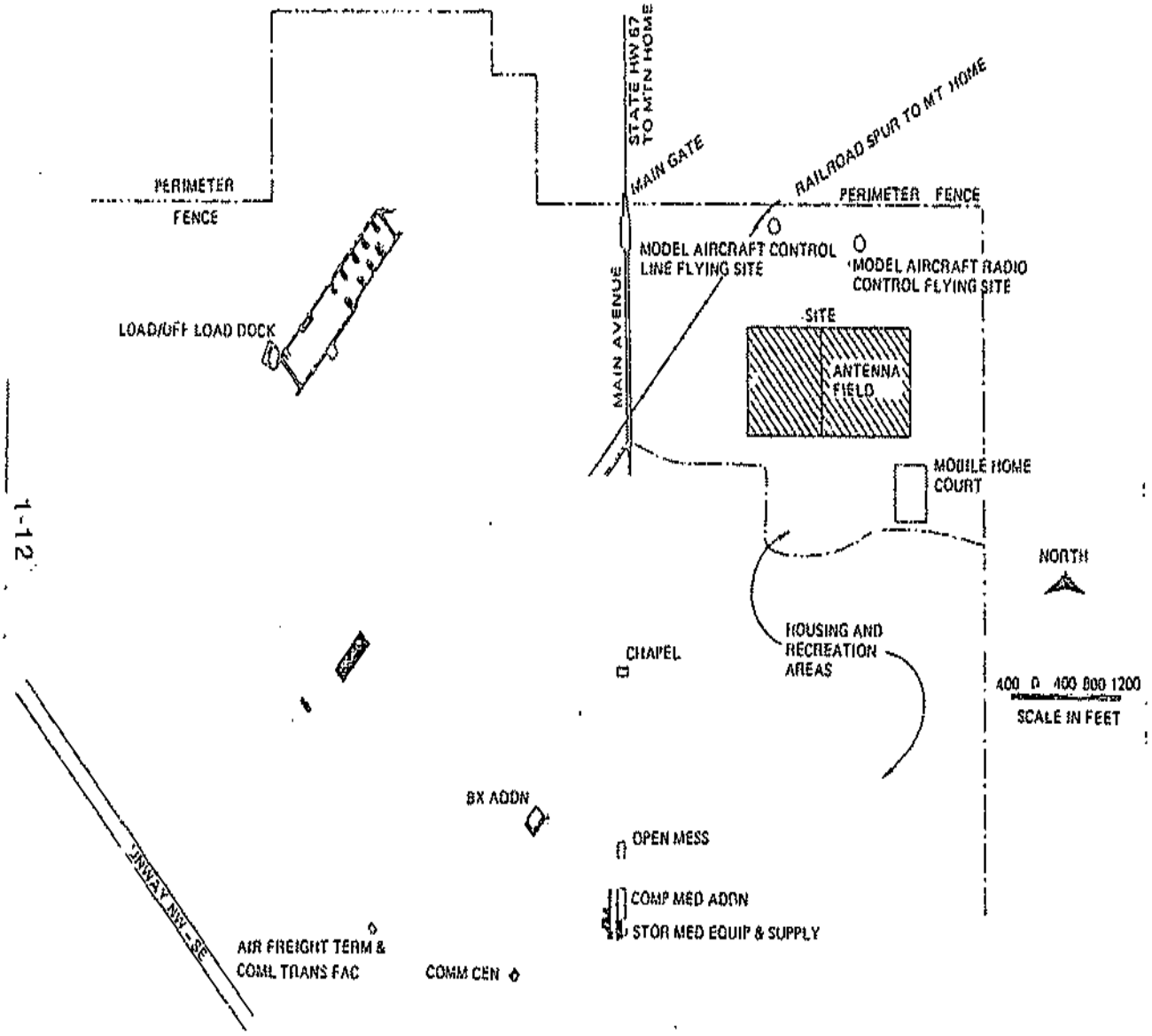

Figure 1-6 Mountain Home Air Force Base Idaho

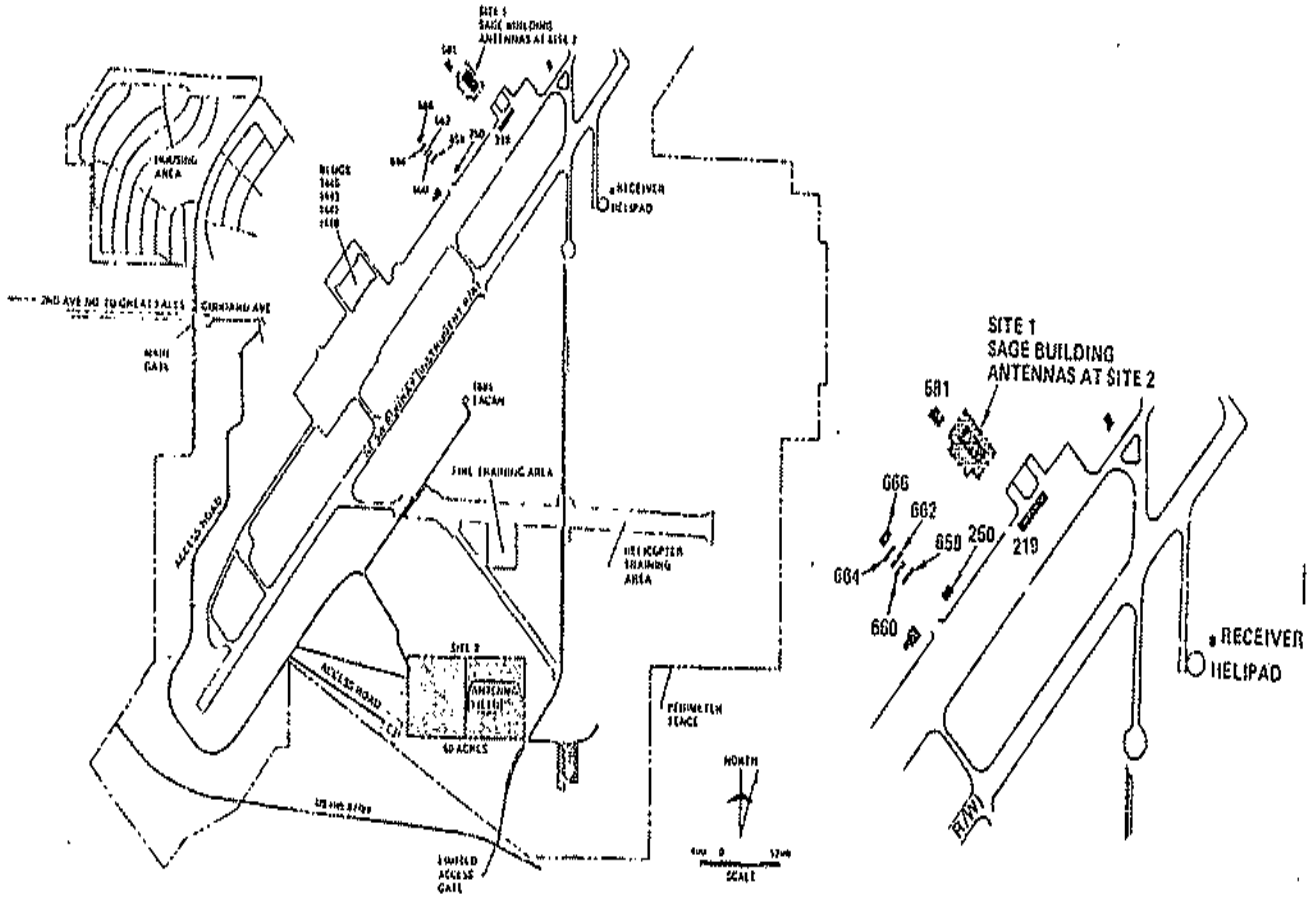

Figure 1-7 Malmstrom Air Force Base (Site 1 and Site 2)

1.6.2 Six potential sites at Kirtland were initially examined; however, four sites were eliminated based on conflicts with aircraft operations flying out of Albuquerque International Airport, EOD operations, civilian housing proximity to the site(s), an existing convoy travel route, and adverse terrain which obscures required look angles. The two remaining sites are designated Sites 1 and 2. For purposes of this initial evaluation, only Site 1 will be examined since it is the more suitable of the two sites. If subsequent considerations for the project location involve Kirtland AFB, Site 2 could be examined further. Figure 1-8 shows the location of the potential six sites with respect to the main portion of the base, the airport, the Indian reservation on the south, and U.S. forest land on the east.

1.6.3 The selectd site - Site 1 - is located at the extreme Southeast portion of the Base, approximately 7-8 miles fror Base Headquarters, and is presently essentially flat, undeveloped grassland. It encompasses an area of over 800 acres, which is more than adequate for the size requirements of the project. The adjoining Indian Reservation is used only for cattle grazing. Forest land to the east is titled "Withdrawal Land" meaning that its use for forest land has been relegated to use by the military for other purposes. The USGS Laboratory is located about 1.5 miles Southeast of Site 1. A tentative location of the proposed facility within Site 1 is shown in Figure 1-9. Access to the site is by way of Lovelace Road which is a controlled military road not open to the General Public. There are no public highways or other publically traveled roads in the vicinity of Site 1.

1.7 BUCKLEY AIR NATIONAL GUARD BASE, COLORADO (Air National Guard). This candidate base is a 3200-acre Air National Guard facility for the state of Colorado located in the city of Aurora on the southeast boundary of Denver. The base is an active air facility with air traffic averaging 1000 takeoffs per month. The Colorado Air National Guard is the host unit at Buckley. Tenant units include the 140th Tactical Fighter Wing; Navy and Marine reserve units, Army National Guard and USAF SAMSO unit. The SAMSO unit consists of the Aerospace Data Facility (ADF) where five antennas are presently in operation with plans for installing two more large antennas and additional warehouse buildings in the near future.

1.7.1 The total working population at Buckley is 2000 employees. On-base support services are limited to a medical dispensary (manned by para-medics on a 24 hour/7 day per week basis), a fire station and a dining hall which serves four meals a day and seats 250 persons. Buckley does not have any on-base housing available for personnel. Normal base support for active duty Air Force personnel is available and supplied by Lowry Air Force Base that is located approximately seven miles west of Buckley.

1.7.2 Three candidate locations were considered for potential location of the proposed facility; however, due to conflicts with the existing ADF antenna transmissions, proximity to residential housing and EED hazards to aircraft utilizing the runways, two of the sites were eliminated from further consideration. The selected site is located at the extreme southwest corner of the base as shown in Figure 1-10. Land to the south of the site is owned by the federal government as a wild life preserve (Plains Conservation District). To the west is residential land, which has not yet been developed;

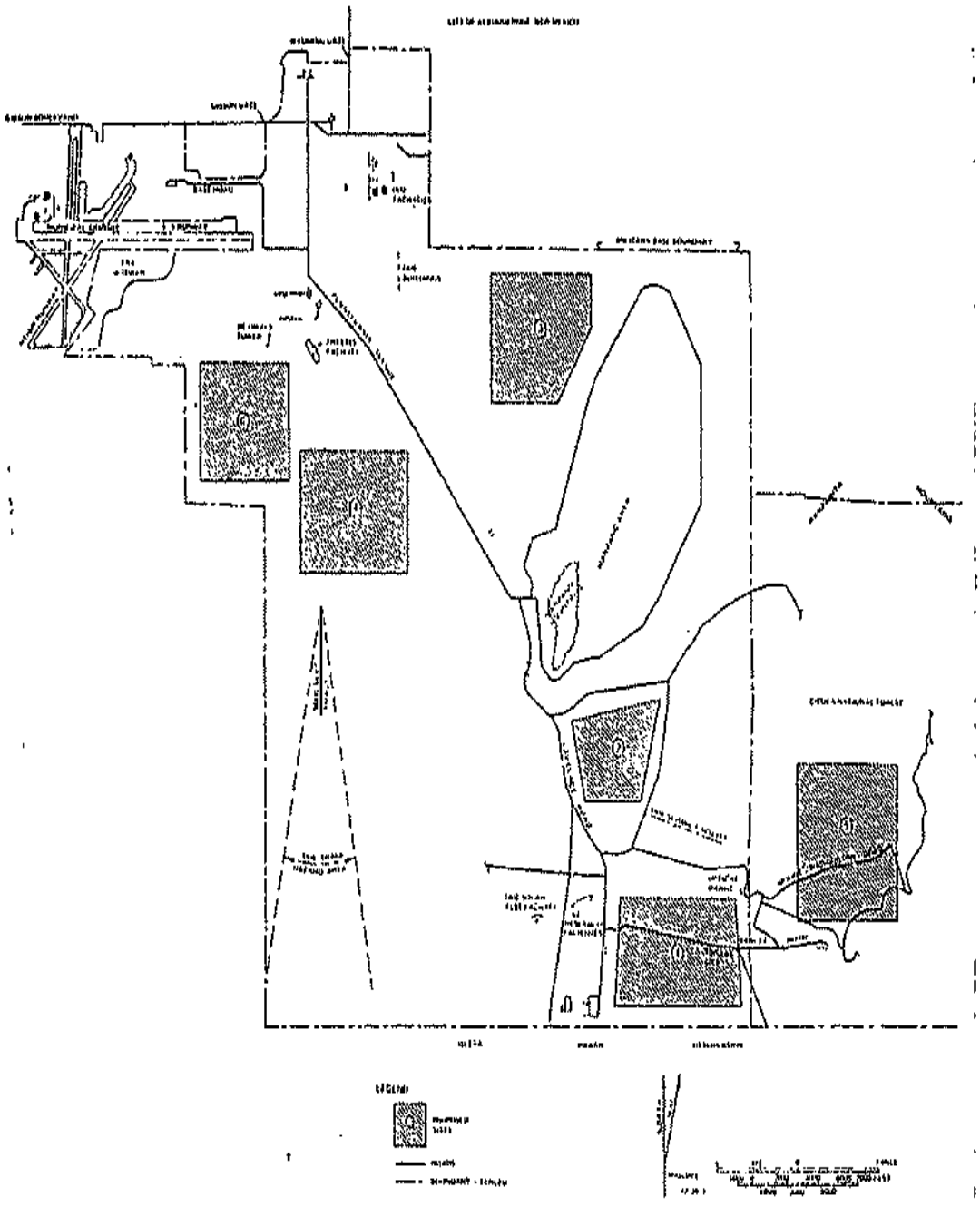

Figure 1-8 Kirtland Air Force Base - Overview

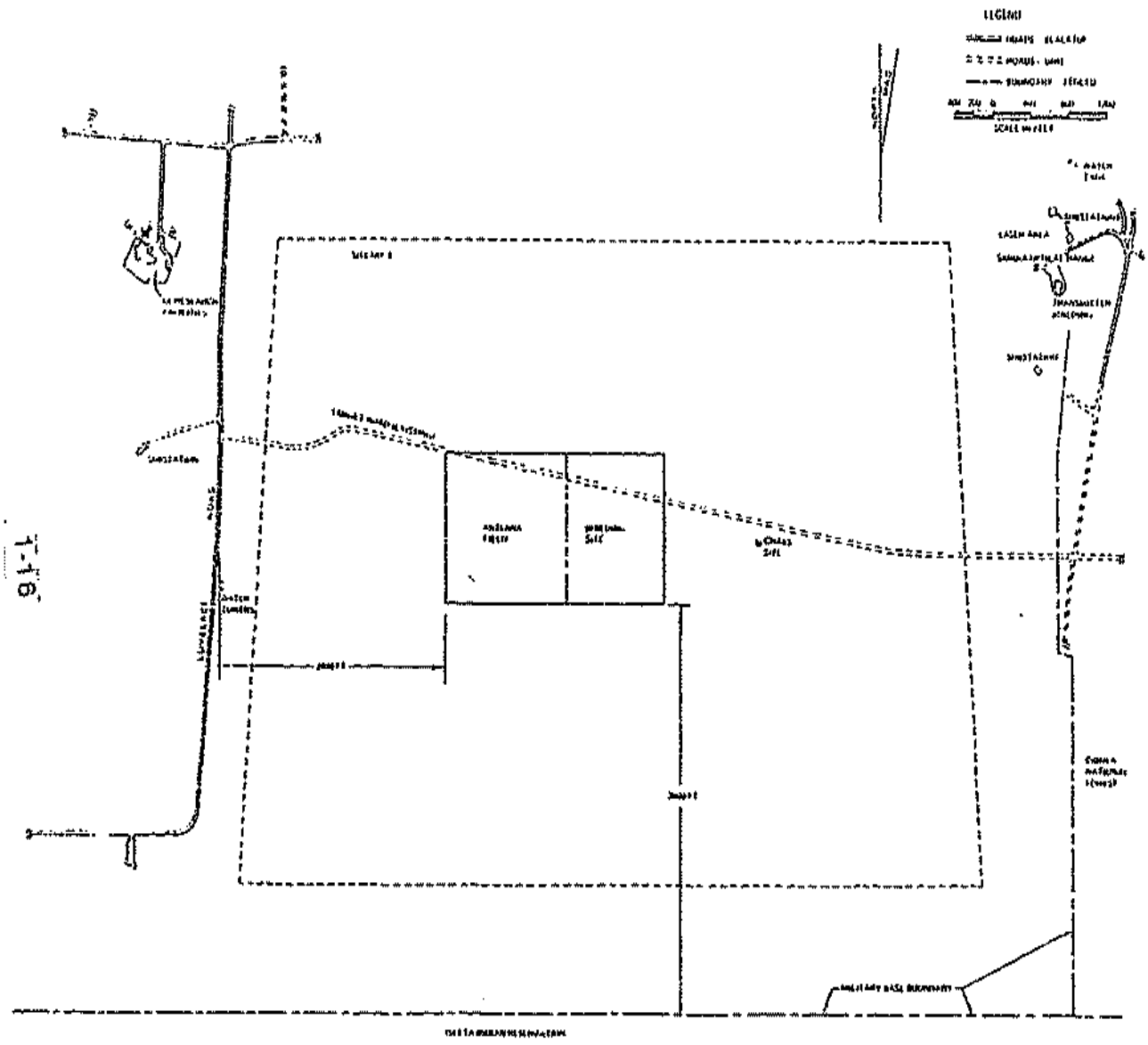

Figure 1-9 Kirtland Air Force Base - Tentative Site Detail

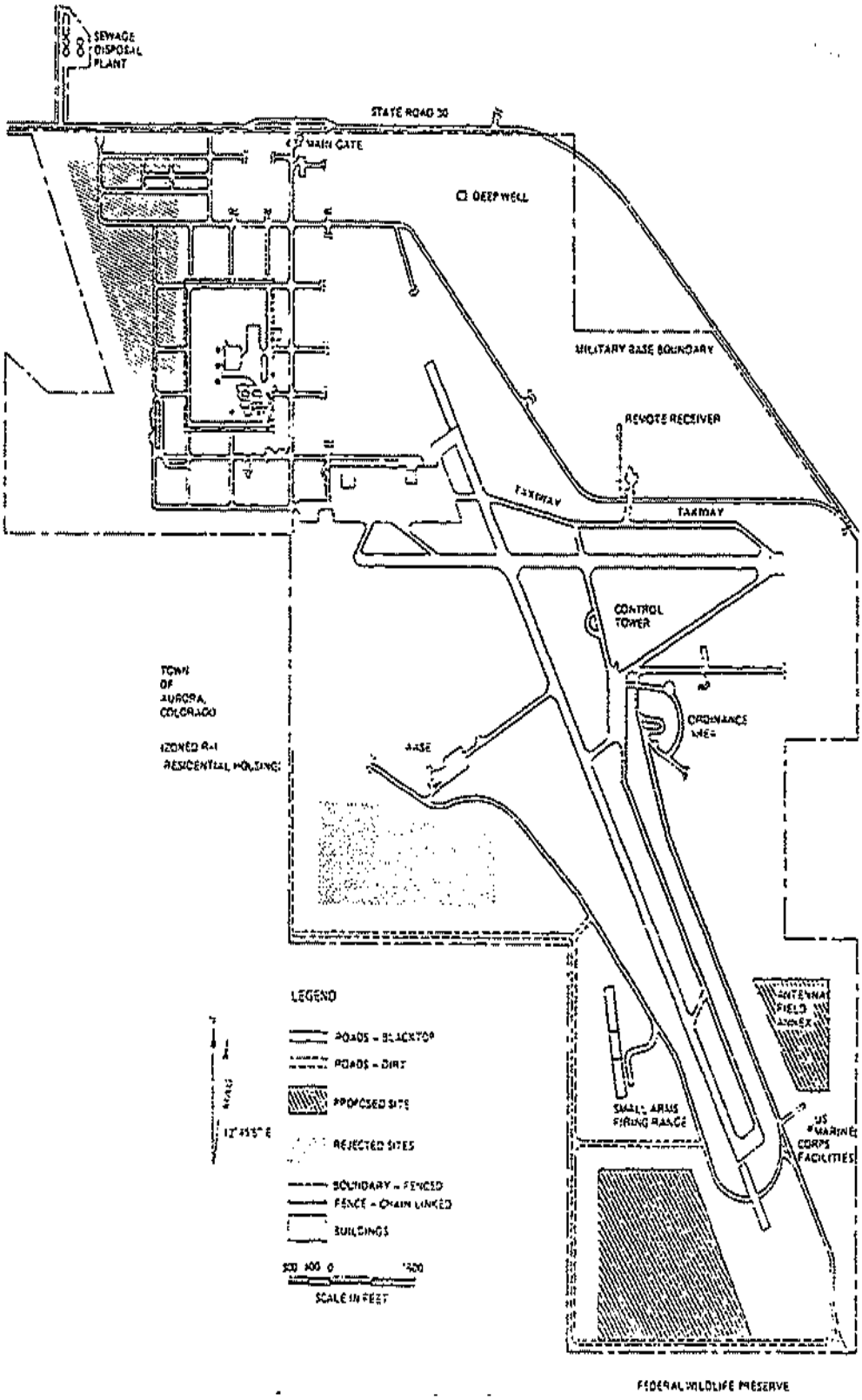

Figure 1-10 Buckley Air National Guard Base

however, its development appears imminent. The existing topography at the site has a fairly large flat area suitable for siting a major portion of the proposed project. Utilization of this site will require remote location of two antennas (those that normally look to the east) to the east side of the main runway so as to avoid transmitting across the runway. The remote antenna location is situated northeast of the site approximately one mile.

1.8 PETERSON AIR FORCE BASE, COLORADO (Aerospace Defense Command). Peterson Air Force Base is located approximately 10 miles east of downtown Colorado Springs. It comprises about 1200 acres of land which is leased from the City of Colorado Springs through the year 2066. Immediately south of the base is the Colorado Springs Municipal Airport, which has plans to construct a new 13,500-foot runway to the east of Peterson AFB. In addition, a new air terminal will be constructed for this municipal airport, utilizing land immediately to the south of Peterson. Unincorporated county area immediately adjoins the east boundary of the base. Peterson contains three major runways which accommodate an average of 45 sorties (military planes) per day; 7 commercial flights per day occur at the municipal airport. The 46th Aerospace Defense Wing, the host unit at Peterson AFB, also supports HQ North American Air Defense Command/Aerospace Defense Command and th NORAD/ADCOM Combat Operations Center in the Cheyenne Mountain complex. The population of Colorado Springs is about 200,000; on-base residential population of Peterson is about 1650. Peterson employs about 2400 military and civilian personnel.

1.8.1 The specific site selected for location of the proposed project is a 110-acre rectangular parcel of land located at the north end of the base adjoining the east side of the main entrance road to the base. A second site - Site 2 - immediately across from Site 1 on the west side of the main entrance road, was not considered due to its marginal size (57 acres) and its inherent limitation for future growth expansion (See Figure 1-11). The main entrance road to Peterson parallels the western border of Site 1; presumably this road could also serve as the primary access to Site 1. Currently this entrance road is open to the public.

1.8.2 Land to the south of Site 1 contains single-family single-story base housing. To the north are storage/maintenance facilities for light industry and open grazing land which will presumably be expanded for either residential or industrial development. East of the site and slightly to the north is a farmhouse which sits on a knoll 60 feet above the average elevation of Site 1. On the site itself, Peterson AFB has plans to construct a "Shoppette" (neighborhood grocery store) in the southwest corner. This building will be a single-story (14 feet) structure.

1.9 CHEYENNE MOUNTAIN COMPLEX, COLORADO (Aerospace Defense Command). The Cheyenne Mountain Complex is located approximately 12 miles southwest of downtown Colorado Springs and 18 miles west of Peterson Air Force Base. The Complex consists of 4.5 acres contained entirely within the mountain in 2.8 miles of excavated chambers and tunnels (completed in 1963) and slightly over 500 acres of external surface land (of which 10 acres are federally owned

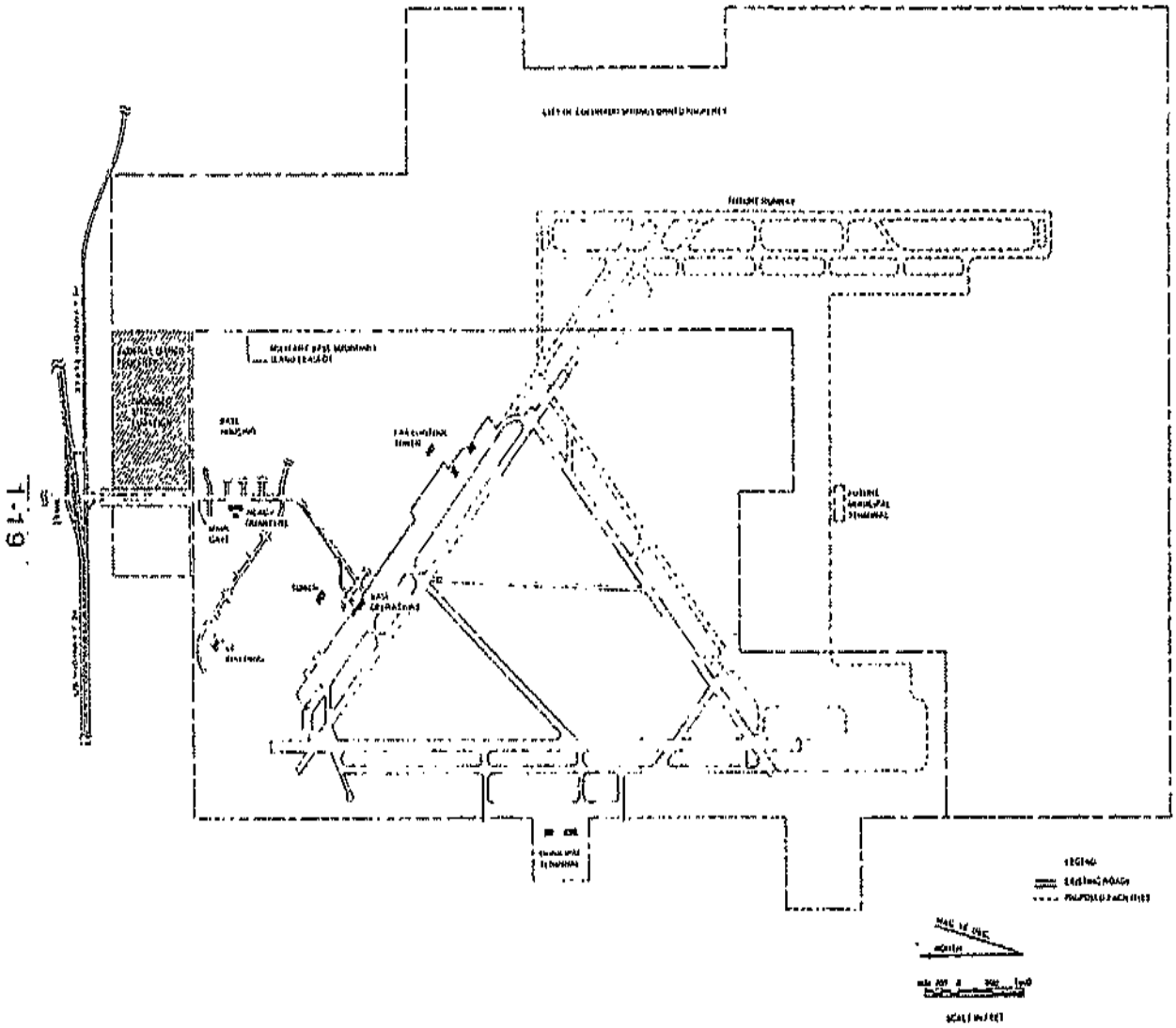

Figure 1-11 Peterson Air Force Base

outright, 68 acres are held under "right-of-way" easements, and 441 acres are under condemnation proceedings). The complex houses a variety of activities in support of the North American Air Defense Command Mission, including medical, Weather Squadron (Detachment 1, 12th WSU), and the National Warning Center (NWC). The 46th Aerospace Defense Wing, with headquarters at Peterson Air Force Base, provides the base support functions required for operation of the facility. These include stocking repair parts, major end items, expendables, and a minimum 30 days supply of petroleum products to ensure sustained operations of the Complex. Fort Carson, a U.S. Army installation, is adjacent to the southeast boundary of the Complex and supplies water and sewage disposal services. The interior Complex is at an elevation of approximately 7000 feet MSL and contains eleven 3-story steel buildings plus several utilities structures as shown in Figure 1-12.

1.9.1 The facility is designed to withstand a nuclear blast and is capable of maintaining a habitable environment for some 600 persons for a maximum period of 30 days. Each building is mounted on springs which allow movements of one foot in all directions without interference from adjoining buildings or the tunnel walls. The floor space contained within the interior facility is 246,000 square feet. The facility is operated on a 24-hour basis with a manpower of about 450 persons per shift. Employees park their vehicles in an existing 450-space parking lot adjacent to the north tunnel entrance, and are then taken by military busses to the interior facility.

1.9.2 The interior of the mountain consists of granite rock. The exterior topography is rugged mountainous terrain typical of the Rocky Mountain foothills. Vegetation is sparse and consists primarily of pine trees and other native vegetation. There are extensive rock outcroppings on the surface which render grading of access roads or flat pads difficult and costly.

1.9.3 The Complex retains jurisdiction over the access road joining nearby state highway route 115 to the tunnel entrance. Land adjoining the access road and the Complex property are privately-owned and are used for grazing.

1.9.4 Hazards presented by earthquake faults, fire, flood, and man-made are minimal within the area, although rockslides occur occasionally down the steep slopes of Cheyenne Mountain. The approach selected for the proposed project, for purposes of analysis, is the utilization of the entire interior building complex for housing the technical and engineering spaces with the antennas located either on top of Cheyenne Mountain or at Peterson Air Force Base. Since the existing complex floor space is inadequate to meet the minimum requirements for the proposed project, the needed additional floor space would be obtained by expansion of the underground complex (i.e., construction of a new technical building in a new interior mountain chamber) and by one new administrative support building just outside the complex entrance. Even such a limited expansion would be very expensive; further expansion required for support of future programs satellites prohibitively costly. Figure 1-12 illustrates a schematic view of the NORAD Cheyenne Mountain Complex.

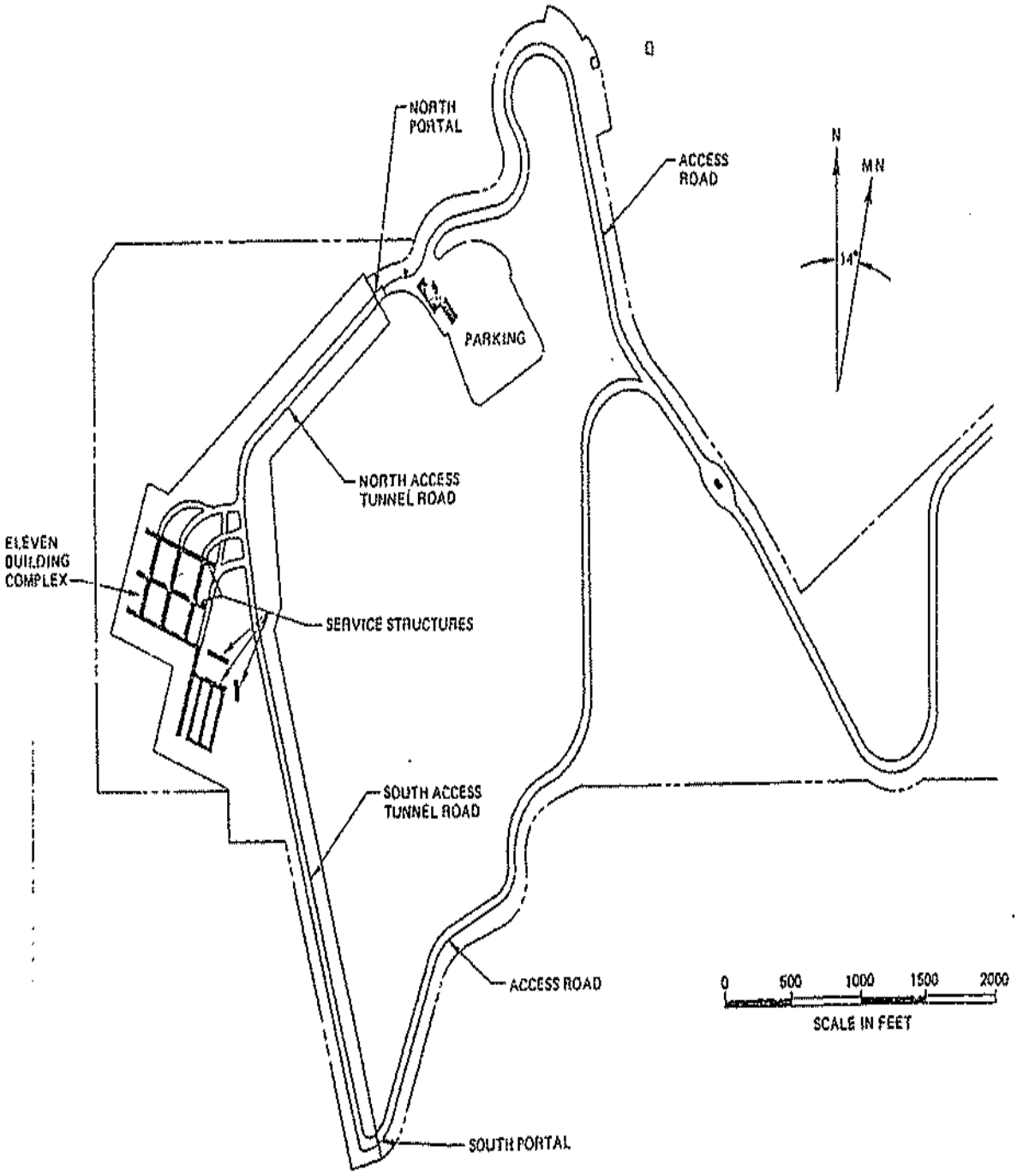

Figure 1-12 Cheyenne Mountain Complex, Colorado

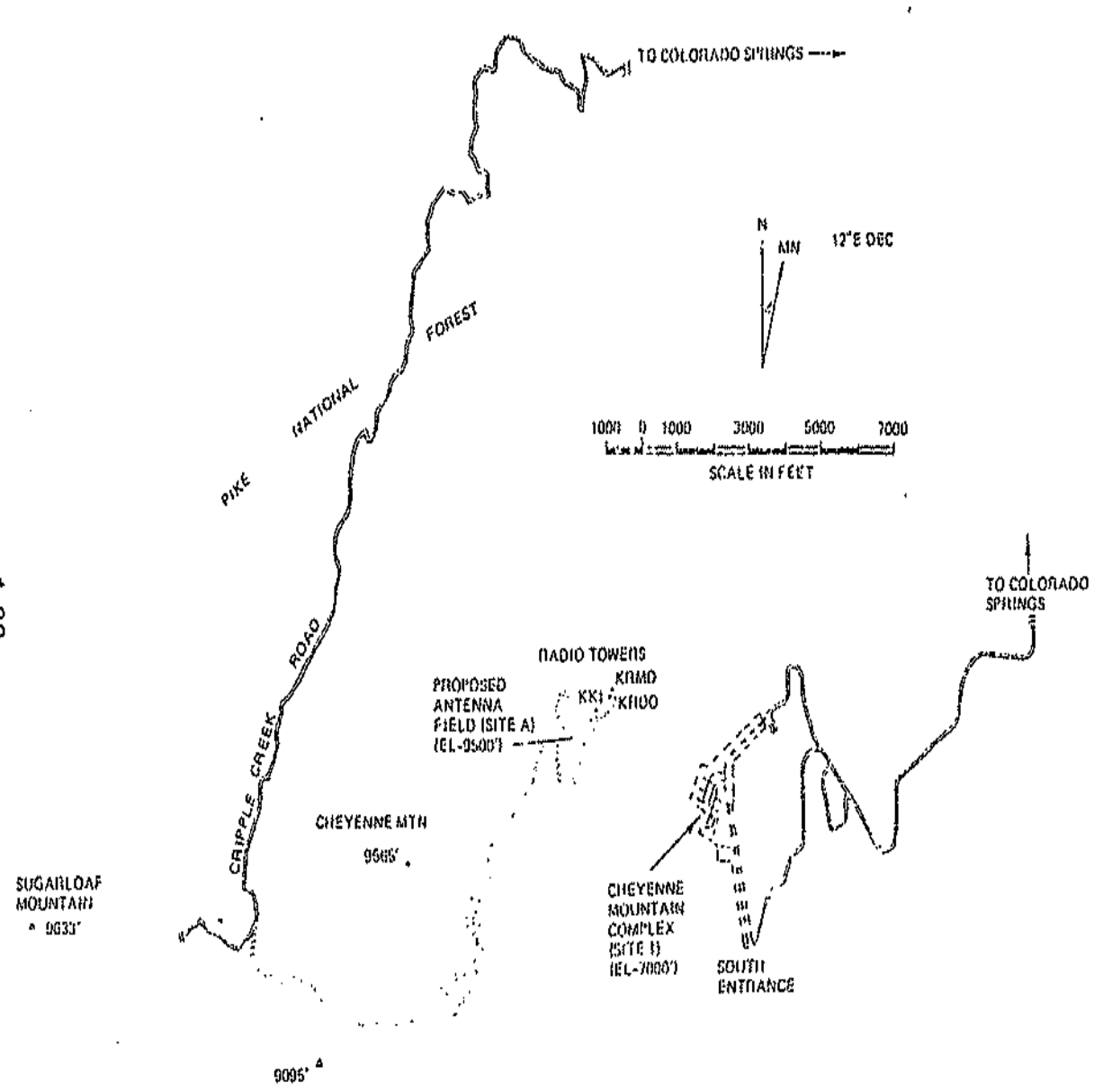

Figure 1-13 Cheyenne Mountain Complex - Overview

1.9.5 Location of the antennas on top of Cheyenne Mountain (Site 1A) will require the extensive improvement of the present typical mountainous switch-back dirt road in order that heavy equipment and concrete trucks can traverse the route between Colorado Springs and the antenna site. The existing road is shown in Figure 1-13. Although the line of sight distance between the complex and the antenna field is approximately one-half mile, the distance between the complex and the antenna field via the access road is over 15 miles.

1.9.6 The alternate location of the Antenna Field is on the federal property at Peterson Air Force Base as described in paragraph 1.8 of this volume. Data would be transmitted by either fiber-optics cabling or via microwave transmission. In the former case, an underground trench would be constructed from the antennas to the technical building - a distance of at least 18 miles. The impacts of grading, construction costs, right-of-way acquisition, etc. are numerous and very costly for fiber-optics system. Impacts associated with the microwave transmission would be considerably less than for the fiber-optics. Only fiber optic links can accommodate very high data rates anticipated in the future, however. The direct line-of-sight distance between Peterson AFB and the Cheyenne Mountain Complex is about 11 miles.

1.10 OFFUTT AIR FORCE BASE, NEBRASKA (Strategic Air Command). Offutt Air Force Base is located about eight miles south of downtown Omaha and adjacent to the southern boundary of the town of Bellevue, Nebraska. The base occupies about 2800 acres that is bounded on the west by a major north/south U.S. highway (US 73/75), on the south and east by the Missouri River 100-year flood plain and on the north but the town of Bellevue. Slightly over 14,000 employees (12,000 military and 2,000 civilian) are employed at Offutt AFB. The city of Omaha has a population of about 363,000, and the regional area that includes Omaha, Bellevue, Papillion in Nebraska and Council Bluffs across the Missouri River in Iowa has a population in excess of 550,000.

1.10.1 The U.S. Air Force Strategic Air Command is headquartered at Offutt AFB with several other activities and units serving missions supporting SAC Headquarters. The host unit at Offutt is the 3902nd Air Base Wing which provides administrative and logistical support to all tenant units on the base. Through the Wing, all financial, supply, civil engineering and related personnel support functions, including medical and dental, are provided for the entire base population.

1.10.2 Major tenant activities, besides HQ SAC, are the 55th Strategic Reconnaissance Wing, the 3rd Weather Wing, 544th Aerospace Reconnaissance Technical Wing, Air Force Global Weather Center, 6944th Security Wing, Air Force Communications Service (AFCS) Strategic Communications Area (SACCA) and 1st Aerospace Communications Group, the 3900th Computer Service Squadron, and the 4000th Aerospace Applications Group. In addition, a detachment of the British Royal Air Force is stationed at Offutt AFB.

1.10.3 The site selected for the proposed facility is a triangular piece of land of about 90 acres located at the southeastern portion of the base as

shown in Figure 1-14. This site currently contains a physiological training center, including an altitude chamber, and explosive ordnance disposal (EOD) facilities. The site is bordered on the north by privately-owned vacant property which is outside the base boundary. On the east is Offutt Lake (located within base boundaries), and on the south and west is the main runway which is heavily used (an average of 1750 sorties per month). A public road parallels the east side of the site and separates the site from Lake Offutt. The site is quite flat and is four or five feet below the adjoining public road on the east.

1.10.4 A levee which borders the north side of the site and the raised public road on the east provide flood protection from overflow of the Missouri River. The entire site is within the 100-year floodplain of the Missouri River; however, the levees described above provide some protection from flooding in storms of lesser magnitude. The site is currently serviced with all necessary utilities such as water, electricity, natural gas and sewer.

1.11 DULUTH INTERNATIONAL AIRPORT, MINNESOTA (Aerospace Defense Command). Duluth International Airport (DIA) is jointly used by both commercial and military flights. The airport is located about 7 miles northwest of downtown Duluth, which is a major shipping port for Lake Superior. During the warmer seasons of the year ships from all over the world (including the Soviet-bloc nations) come to Duluth for loading grain and heavy machinery.

1.11.1 The Air Force facility is located adjacent to the south of the main east-west runway on land partially leased from the city of Duluth to the year 2013 and on federally owned property. The air facility is comprised of about 2000 acres total (of which approximately 116 acres are leased) and employs approximately 1100 military and 300 civilian personnel.

1.11.2 The city of Duluth has a population of about 100,000 and the whole metropolitan area is approximately double this number. The population in this area is comparatively stable with very little new developments occurring at present. The major industry in Duluth is shipping, which is extremely active when the St. Lawrence River waterways thaw. Thus unemployment in the Duluth area is highly seasonal, running to about 7% in the winter and then decreasing as the shipping season starts.

1.11.3 The host activity for the base facility is the 4787th Air Base Group and USAF Clinic, Duluth. Tenant activities include 23rd NORAD Region/Air Division, 23rd Air Defense Squadron, Detachment 8 (12) Weather Squadron, Detachment 1315 Air Force Office of Special Investigation, Region 33 Defense Investigative Service and Defense Property Disposal Unit.

1.11.4 Two potential sites have been identified for the proposed project at DIA. Site 1 - the SAGE facility - is located in the southwest portion of the base, immediately adjoining U.S. Highway 53. The SAGE building is completely fenced, and access to the building and adjoining property is via a guard gate. The site may be reached from U.S. Highway 53, and also from the rest of

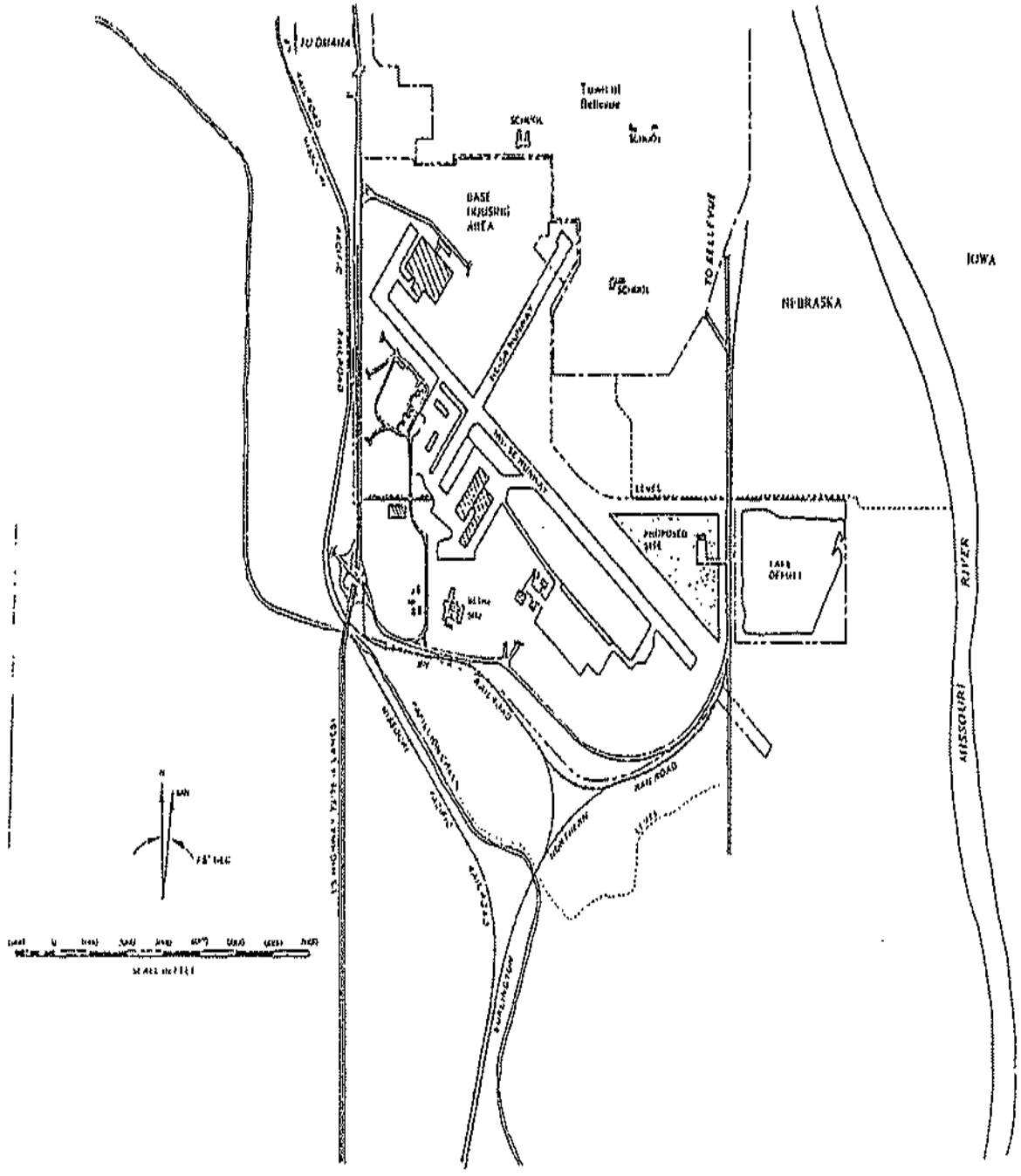

Figure 1-14 Offutt Air Force Base, Nebraska

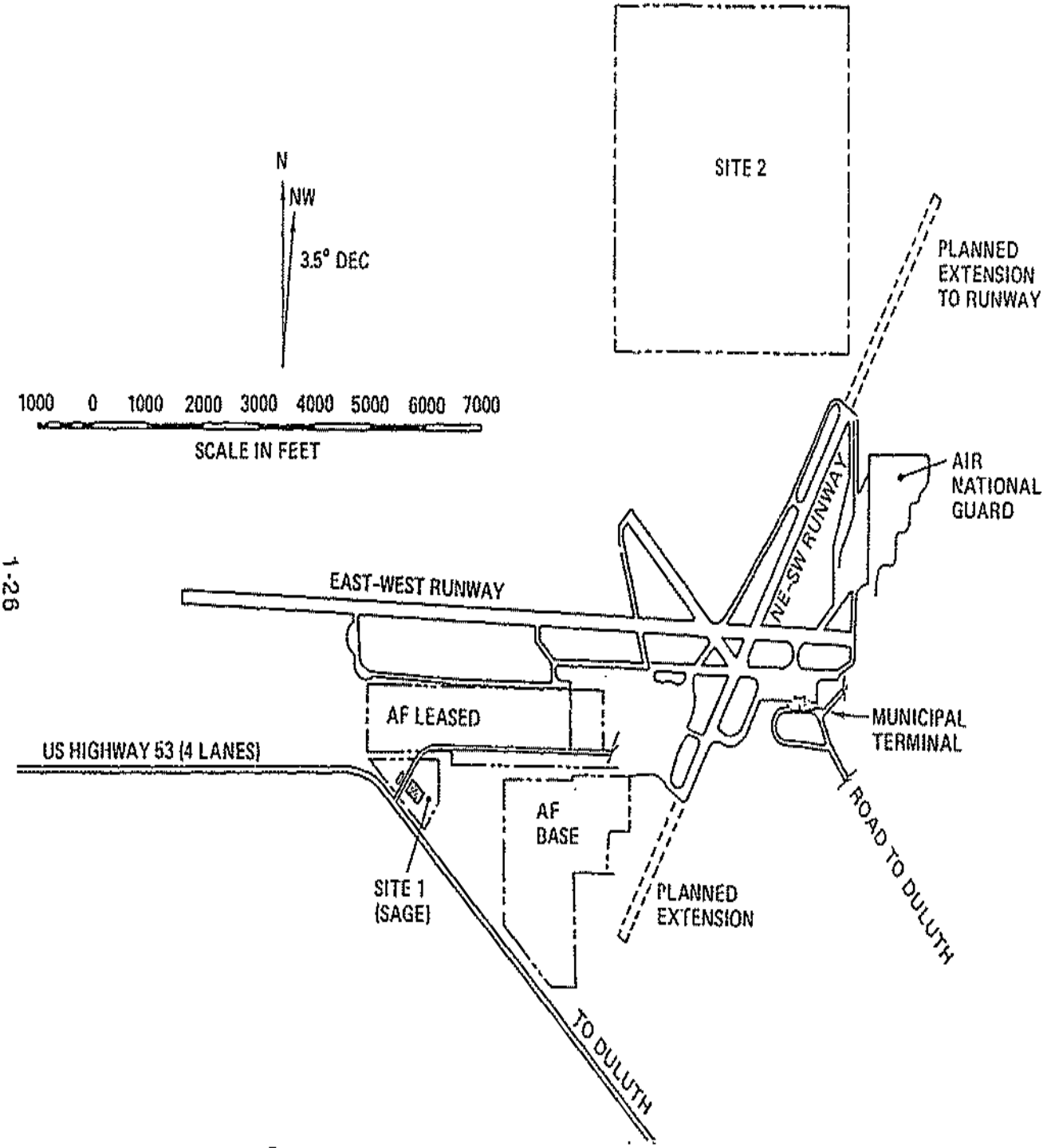

Figure 1-15 Duluth International Airport , Minnesota

the base via the base interior road system. Site 1 has utilities at the site, including water, power and sewer main. Site 2 - the old "Goose Missile Facility" - is remotely located on the opposite side of the base. It is north of the runway used for both commercial and military flights. There are no utilities to the site at this time; the closest utilities are at the Air National Guard facility about 3/4 miles to the southeast (also located on the north side of the main runway). Access to Site 2 is presently from the main base, which must be reached by going around the west end of the runway. The only other alternative is to cross over the runway itself, which is undesirable as a routine access route. The distance between Site 1 and 2 is 6 vehicular miles. The base does have an easement across privately-owned property to the north of Site 2 which would permit connection to a public road 0.2 mile to the north of the site.

1.11.5 If Site 1 is utilized, the antennas will be remotely located at Site 2. If Site 2 is selected, the entire facility will be constructed at that site. See Figure 1-15.

1.11.6 Plans have been made by the City of Duluth to extend the NE-SW runway from its present length of 5700 feet depending on funding capability in the next few years.

1.12 HANCOCK FIELD, NEW YORK (Aerospace Defense Command). Hancock Field is located approximately 6 miles north of the city of Syracuse, New York. It is surrounded by a number of small villages. The standard metropolitan statistical area contains about 650,000 people with the city of Syracuse having a population of about 180,000. Syracuse is the urban center for this part of New York state. Modern expressways and good primary roads link the air field with Syracuse and other communities in the region. Hancock Field is a relatively small Air Force installation comprising some 450 acres of land. The southeast and southwest portions of the Field are primarily swamp land. Construction within these areas would require extensive drainage and fill as well as installation of special foundations. There are presently 1000 military and 300 civilians at the base. The runways are jointly used for both military and commercial flights. The Syracuse-Hancock International Airport Terminal is located at the Western edge of the E-W runway.

1.12.1 The host activities at Hancock Field are the 4789th Air Base Group and the USAF Clinic. Tenant activities include the 21st NORAD Region/Air Division/Air Defense Squadron, 4799th Special Activity Squadron, USAF Judiciary Area Defense Counsel, Detachment 110 Special Investigations Office, Detachment 21 (12) Weather Squadron, U.S. Army NE Telecommunications Switching Center (NETSC), 174th Tactical Fighter Wing, Civil Air Patrol, Marine Corps Reserve Training Center and Detachment 103 (3501) USAF Recruiting Group.

1.12.2 The specific site selected for location of the proposed project consists of the SAGE facility where the technical and other support buildings would be housed, and a nearby area approximately 750 feet to the southeast

where the antennas would be located as shown in Figure 1-16. A data communications link consisting of underground fiber-optics cable will connect the SAGE facility with the antenna site.

1.12.3 The SAGE facility consists of several buildings adjacent to the north main gate; the antenna site is a fairly level area located immediately across the street from the Base Commander's private residence. The elevation of the site is about 20 feet below Thompson Road which borders the west side of the site and separates the antenna site from the Base Commander's property. The site contains several groves of trees which would have to be removed. Immediately adjoining the site on the southeast is the Base Vehicle Maintenance Facility. Although utility services are available at or near the areas selected for the proposed project, commercial electrical power is not at present connected to the SAGE facility. All electric power is now provided by six generators driven by diesel engines located on site with short-term power provided by batteries.

1.12.4 Location of the site as proposed will result in a number of impacts on existing facilities and amenities. These include complete removal of existing tree groves, relocation of roads and the main gate, and the attendant increased traffic congestion in and surrounding the base with the influx of a much larger labor force for the proposed project. Of additional concern is the possibility that the extreme age of the base commander's residence, estimated to be 160 to 180 years of age, will qualify it for inclusion on the National Register of Historic Buildings.

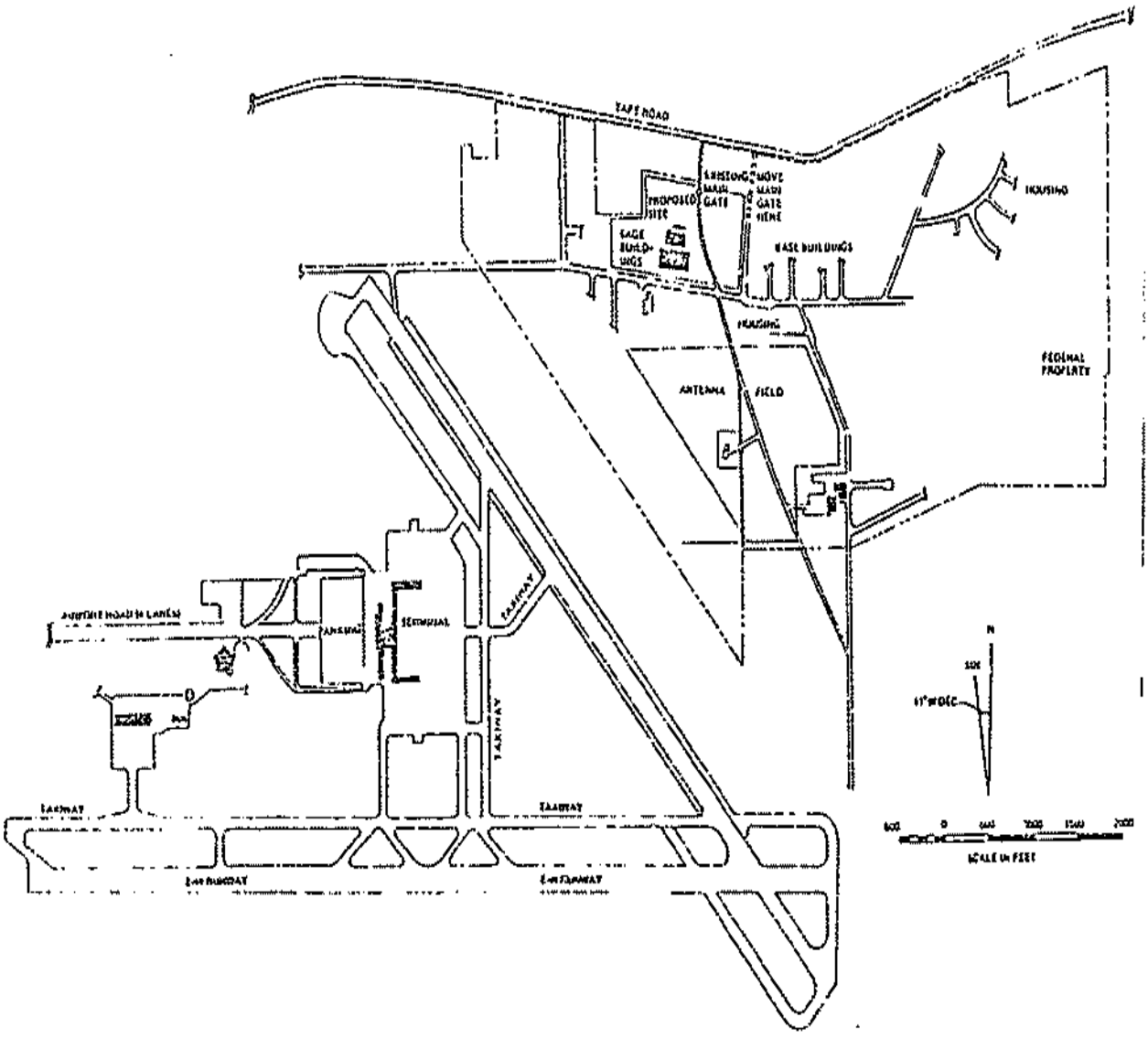

Figure 1-16 Hancock Field, New York

SECTION II - SITE EVALUATION

This section presents an evaluation of each of the candidate installations in four main areas:

a. Siting Criteria
b. Environmental Impact
c. Base Support Capability
d. Resource Implications

2.1 SITING CRITERIA. Each site was assessed against the criteria specified in the Executive Summary. The discussions of certain criteria are brief; the criteria were used to eliminate many potential bases prior to the survey, and the bases actually visited automatically satisfied many of the siting criteria.

2.1.1 Satellite Communications. This section addresses long-haul communications through DSCS satellites and local obscura conditions.

2.1.1.1 DSCS Satellite Visibility. Antenna elevation angles to the Defense Satellite Communications System (DSCS) satellites constrain site selection. To maintain visibility with the Western Pacific (WESTPAC) satellite a nominal minimum antenna elevation angle of five degrees is necessary to maintain desired link margins. Table 2-1 show the azimuth (True) and elevation angles which would be realized at each of the bases.

2.1.1.1.1 The WESTPAC elevation angle at Hill AFB marginally fails to meet the criterion. Potential impacts of the low elevation angle are reduced signal margin (i.e., increased bit error rate) and acquisition uncertainties. The terrain to the west of Hill AFB drops significantly, however, and there are no mountains obscuring or encroaching upon the line-of-sight between the antenna and the satellite. Based on these factors and experience in similar situations, operation at 4.15° is considered feasible but difficulties are possible.

2.1.1.1.2 Malmstrom AFB, Kirtland AFB, Buckley ANGB, Peterson AFB, Cheyenne Mountain, Offutt AFB, Duluth IAP, and Hancock Field do not meet the criterion given the current location of the WESTPAC satellite. An easterly move of the WESTPAC DSCS is required as shown in Table 2-1, to permit minimum visibility from these sites. Movement of the WESTPAC DSCS to a position that would provide visibility at Hancock Field would place the satellite only 10 degrees away from the EASTPAC DSCS and eliminate direct access from the entire western Pacific region. Movement of WESTPAC to permit visiblity at Offutt or Duluth would have nearly as severe an impact. Hancock--but not Offutt or Duluth--is within the footprint of the Atlantic DSCS satellite, but this would only partially compensate for its inability to utilize WESTPAC.

2.1.1.2 Local Obscura. Measurements made on site by the survey team and data furnished by the Electromagnetic Capability Analysis Center (ECAC) in Annapolis, MD, were used to address this criterion. None of the candidate

Table 2-1 DSCS Viewing Angle

	EASTPAC		WESTPAC					
	Current Location		Current Location (175°E)		If Moved East To Longitude			Westernmost Longitude Which Provides 5° Elevation Angle At Site
					180°W	177.4°W	175°W	
	Az	El	Az	El	El[1]	El[1]	El	
Luke AFB	217.2°	45°	260.3°	5.5°	–	–	–	–
Nellis AFB	211.8°	44.7°	258°	7.6°	–	–	–	–
Hill AFB	213°	38.5°	259.7°	4.15°	7.99°	–	–	176°E (1° Move)
Mountain Home AFB	207°	36.2°	255.4°	6.7°	–	–	–	–
Malmstrom AFB	212°	31.4°	–	<5°	5.32°	–	–	179°E (4° Move)
Kirtland AFB	223°	41.1°	–	NOT VISIBLE	5.30°	–	–	180°W (5° Move)
Buckley ANGB	222°	35.8°	–		<5°	5°	–	177.4°W (7.6° Move)
Peterson AFB	222°	35.8°	–		<5°	5°[2]	6.92°	177.4°W (7.6° Move)[2]
Cheyenne Mt. Complex	222°	35.8°	–		<5°	5°[3]	6.92°	177.4°W (7.6° Move)[3]
Offutt AFB	231°	29.4°	–					168°W (17° Move)
Duluth IAP	226°	13.5°	–					162.2°W (22.8° Move)
Hancock Field	248°	14.2°	–					145°W (40° Move)

[1] Azimuth omitted; it ranges from 255° to 250°

[2] Not adequate due to obscura presented by mountainous terrain west of Peterson AFB. 10° move to 175°W required for this site.

[3] Adequate for Site 1A (Antennas at summit of Cheyenne mountain); Not adequate for Site 1B (Antennas on Peterson AFB).

sites except Kirtland AFB had any terrain or man-made features which would obscure the line-of-sight between any antenna and communications satellite in the project baseline. (In some cases the site initially recommended by the base was relocated to achieve acceptable elevation angles.)

2.1.1.2.1 At Kirtland AFB, the DATA Link Terminal (DLT) antenna line of sight to the northeast is slightly obscured. (Mountainous terrain ranges from 4^{o} to 5^{o} elevation across a 45^{o} portion of the northeast support quadrant, in which it is desired to operate at elevation angles as low as 3^{o}.) Preliminary analyses indicated that this would not create an operational problem, as indicated in SAMSO/CV message 141900Z November 1978. Subsequently, more detailed analyses of satellite deployment data and precise antenna look angles confirm the preliminary finding of no operational impact. Sufficient visibility and satellite overlap exist in the northwest support quadrant to alleviate the obscura problem to the northeast.

2.1.1.2.2 Although Nellis AFB met the requirements for minimum elevation angles for all antennas in the baseline, it should be noted that terrain to the southeast could potentially cause problems for future missions (not yet in the conceptual phase) requiring lower viewing angles and/or different azimuths. A similar terrain problem exists to the east of Hill AFB and Kirtland AFB and to the west of Peterson AFB, and there are man-made structures relatively near Site 1A at Luke AFB.

2.1.2 Electromagnetic Phenomena. Three separate siting criteria were defined in this category: mission compatibility-EMI/RFI, mission compatibility-aircraft operations, and EMR exposure. These are complex criteria, as implied by the explanation of each one presented previously. Typically, several aspects of each criterion must be considered in order to evaluate the sites.

2.1.2.1 Mission Compatibility-EMI/RFI. Assessment of the first five (5) candidate sites for electromagnetic compatibility with STC II was initiated prior to the survey. A list of emitters at each base was provided by ECAC. This data on existing emitters was compared with the operating characteristics of proposed STC II antenna systems to identify possible interference. For the last seven sites surveyed, ECAC data was not available prior to the surveys. During the surveys, additional data was obtained at all sites, and potential problem areas were discussed. All STC II antenna systems are continuous emitters rather than pulse emitters, such as radars. Their operating characteristics are as follows:

Antenna	Freq. (GHz)	Normal Power (Watts)	Peak Power (Watts)
DSCS	7.9 - 8.4	100	4,230
SCDRS	30	500	3,000
DLT	1.74 - 1.85	500	2,000
DOMSAT	5.925 - 6.425	50	75

2.1.2.1.1 The results of the ECAC review and the site survey indicate that Nellis AFB, Buckley ANGB, and Offutt AFB are the only sites at which electromagnetic compatibility problems appear to exist. In addition, a potential problem may exist at Duluth IAP with a programmed change to the electronic equipment assigned to the Tactical Reconnaissance Group of the Minnesota Air National Guard located adjacent to the southeast border of Site 2. Further, although several major test facilities are located on Kirtland AFB, information obtained during the survey indicates that there is no EMI/RFI problem because of the distance of the STC II location from the test facilities. Nellis, Buckley, Kirtland, and Offutt are addressed individually in the subparagraphs below.

2.1.2.1.2 Nellis AFB has over 220 military frequencies assigned between 1.7 - 8.4 GHz. These frequencies are used to support the missions of the 440th Tactical Fighter Training Group and Tactical Fighter Weapons Center Range Group. Although most of the equipment assigned these frequencies is used on the ranges, the equipment is maintained and tested on Nellis AFB, about four miles from the proposed site, and the possibility of RFI cannot be dismissed. It should also be noted that possible new equipment in the future in these and other RF bands could have an adverse impact on compatibility between STC II and these missions. Therefore, Nellis AFB should be considered a marginal candidate with respect to electromagnetic compatibility considerations.

2.1.2.1.3 Further technical analyses, RF surveys, and operational studies of potential constraints on present and future range activities would be required to resolve the question of Nellis AFB RFI compatibility with AFSCF requirements. Another possibility would be to place STC II off the main base away from the ranges located to the north, in an area which would decrease RFI by increasing the distance from emitters and/or taking advantage of terrain shielding. Although this survey was restricted to sites on or controlled by active Air Force bases, land administrater by other government agencies, such as the Bureau of Land Management, might be available in the Nellis area.

2.1.2.1.4 At Buckley ANGB, existing antenna systems operated by the 2nd Communications Squadron (ADC) employ individual S-band frequencies identical to ones used by a STC II antenna system. Not only is there the possibility of RFI during satellite support periods, but there is also the potential for actual damage to front-end electronics if the STC II antenna beam were aimed at one of the existing systems. The latter problem could be solved with mechanical lock-outs which would prevent transmissions in specified azimuth/elevation sectors, with little operational impact. The former problem would require a high degree of coordination between STC II and 2nd Communications Squadron operators. Thus Buckley ANGB must also be considered a marginal candidate from an EMI/RFI standpoint.

2.1.2.1.5 Several facilities at Kirtland AFB were investigated for potential EMI/RFI to STC II antenna systems: the Air Force Weapons Laboratory's (AFWL) Vertically Polarized Dipole (VPD) antenna utilized for EMP experimentation; Sandia Corporation's Electron Beam Fusion Facility (EBFF), operated for the Department of Energy; and the AFWL Sandia Optical Test Facility, used for laser experimentation. The first two installations are operated intermittently at various times during the day; and at each facility a single high energy pulse is emitted during each operaton. Radiation levels are maintained below the current Air Force Surgeon General standard of 100,000 volts/meter. Discussions with AFWL and information received concerning Sandia Corporation operations resulted in general agreement that no direct in-band frequency EMI/RFI problem would exist. Corona discharge effects at the EBFF could create RF radiation at STC II operating frequencies, but the radiation would be significantly attenuated by the six mile distance to the proposed facility site. Detailed RF radiation measurements will be conducted to verify facility compatibility if Kirtland AFB is selected for siting STC II.

2.1.2.1.6 Discussions were also conducted with AFWL personnel at Kirtland AFB regarding the Sandia Optical Test Facility. No incompatabilities are anticipated between this facility and STC II. The optical facility is located on a hilltop east of the proposed STC II site, and the three ranges used for laser experimentation extend down and to the east of the test facility itself, i.e., away from STC II.

2.1.2.1.7 Existing ground electronics calibration and testing activities conducted by the 55th Strategic Reconnaissance Wing on Offutt AFB will be highly susceptible to interference from STC II antenna systems. Accordingly, Offutt AFB must be considered a marginal candidate from an EMI/RFI standpoint.

2.1.2.2 Mission Compatibility-Aircraft Operations. Passage of aircraft through STC II antenna beams presents potential hazards to the aircraft and potential interruption of STC II communications. Both possibilities are addressed below.

2.1.2.2.1 Hazards to Aircraft. A preliminary analysis conducted by ASD/ENAMA, Wright-Patterson AFB, OH , concluded that no hazards are presented to aircraft avionics but that a potential hazard to airborne electro-explosvie devices (EEDs) and electronics systems (such as ejection seat initiators, tip tank release mechanisms, anti-skid braking systems, etc.) does exist. Data gathered during the survey concerning the location of each site relative to the runway(s) and subsequent analyses confirmed that maximum safe EED power density thresholds are exceeded at most sites under certain circumstances.

2.1.2.2.2 The EED hazard exists for peak power operation of the SCDRS, DSCS, or DLT antenna. It applies to aircraft in takeoff/landing configuration which are operating in specific sectors with 2.75 nautical miles of the STC II antennas, and to aircraft in flight with internal or external EEDs within 1.25 nautical miles. Antenna Site 1A at Cheyenne Mountain Complex meets this criterion, as does the site at Kirtland AFB, because of this distance from the runways. (The hazard zone during peak power operation would come no closer than approximately 4.5 miles from Kirtland's runways. Therefore, a satisfactory resolution of this problem is achievable without causing a significant impact on aircraft operations at Kirtland.) Sites 1B and 2 at Luke meet the criterion with the qualification that aircraft operations at Aux 1 are conducted with certain restrictions (suspended) while peak power operation is required. Assuming a suitable location could be found, Site 1C at Luke would meet the criterion. Site 1A at Luke AFB and all sites at the remaining bases do not meet the criterion.

2.1.2.2.3 Communications Interruption. An aircraft flying through an antenna beam momentarily attenuates the signal. The degree of attenuation depends principally on the relative size of the aircraft and antenna beam, whereas the duration is a function of flight path and velocity. Typical links between antennas and communications satellites have low margins, and the attenuation may very well be sufficient to increase the bit error rate to an unacceptably high level until the aircraft exits the beam. As a result, a potential problem exists at all sites near traffic patterns, but its significance cannot be assessed without further technical and operational analyses.

2.1.2.3 EMR Exposure. The current OSHA standard for human occupational exposure to electromagnetic radiation (EMR) is 10 mw/cm^2. The standard is under intense scrutiny by the scientific community, and it is anticipated that it will be reduced by one to two orders of magnitude in the future. Accordingly, a 0.1 mw/cm^2 standard was adopted for survey purposes.

2.1.2.3.1 Antenna EMR was carefully analyzed for each site. Based on methodologies contained in AFCS T.O. 31Z-10-4, every site appears to satisfy the criterion, i.e., no calculated hazard is presented to personnel in STC II facilities, in nearby structures, or on the ground outside the fenced antenna field. Eight sites merit special mention, however. Site 1A at Luke AFB directly adjoins a congested area of the base which includes the hospital and family housing. The Hill AFB and Mountain Home AFB sites are relatively close to heavily travelled transportation corridors and family housing areas, respectively. Buckley ANGB site is immediately adjacent to land zoned for residential construction. The Peterson AFB site is between base housing areas and off-base commercial and residential areas. Cheyenne Mountain Site 1B has the identical antenna field location (on Peterson AFB), hence the same problem. The Offutt AFB site is along the base boundary and adjacent to commerical and residential areas. The Hancock Field site is in the middle of a small base which is directly adjoining a commercial airport and surrounded by local communities. If an EMR exposure standard even more stringent than the conservative one used for the survey were adopted, acceptable antenna locations might not be available at these eight sites.

2.1.3 Security This section addresses the vulnerability of STC II to two types of threat: (1) natural, i.e., geological, meteorological, fire, etc., and (2) physical, i.e., inadvertent or deliberate disruption or compromise of facility operation.

2.1.3.1 Natural. The regions surround Offutt AFB, Duluth International Airport, and Hancock Field are subject to tornadoes. Offutt is especially vulnerable during the spring months. (In addition, Offutt is subject to floods of the Missouri River.) All other surveyed sites are located in areas that have little tornado or hurricane activity, although all are subjected to thunderstorms and occasional gale-like winds (gusts to 60 knots). The thunderstorms cause potential flooding conditions at Site 1 of Luke AFB and at Nellis AFB. All sites except Hill AFB are located in Seismic Zone I (minor damage) or II (moderate damage), either of which is considered an acceptable risk. Pertinent data for Luke, Nellis, Offutt, and Hancock and the earthquake threat at Hill are examined below.

2.1.3.1.1 Luke AFB The base and Site 1 are subject to local flooding following heavy precipitation. An improved flood control channel passes through Site 1 in a northwest/southeast direction near the existing structures. In 1978 this channel was within a few inches of overflow following an intense storm. A complete drainage study is now underway by the base to alleviate the drainage problem in the future. A salt dome underlies the base and surrounding public areas. A commercial salt extraction operation is being conducted within 1/2 mile of the northern base boundary, and portions of the salt dome (1,000 to 2,000 feet below the surface) are being used for storage of up to 50 million gallons of low pressure natural gas. The gas is transported via railroad cars to the wellheads during low demand periods and removed during high demand periods. This operation poses a potential fire/explosion threat to operations at the base, which includes the Site 1 area. There is a further potential impact from the unknown effect of an explosion on the geologic structure beneath and adjacent to the base. Site 2 at Luke AFB exhibits none of these vulnerabilities.

2.1.3.1.2 Nellis AFB. The base area including the shallow valley containing the proposed site slopes to the southwest and provides natural drainage. Heavy storms produce occasional temporary local flooding in the area. It is estimated that a 50-year flood would cause a loss of 20 homes on the southwest portion of the base. There are few man-made drainage improvements on the base and none in the immediate area of the site; however, the potential for flooding can be mitigated by proper site development layout and design.

2.1.3.1.3 Offutt AFB. The base adjoins the Missouri River. Substantial areas of the eastern portion of the base, in which the proposed facility would be sited, were under water during the great flood of 1953. Although protective levees have been constructed, this portion of the base is still considered to be in the 100-year flood plain of the river.

2.1.3.1.4 Hancock Field. The region surrounding Hancock Field will have an average of four to six heavy storms each year that have tornado or severe thunderstorm potential. Infrequent gale-like winds between 60-70 miles per

hour have been recorded at Hancock Field in late fall or winter. This region is also frequently subjected to heavy rains on the edge of tropical coastal storms.

2.1.3.1.5 Hill AFB. Hill AFB is in a Seismic Zone III as a result of the Wasatch Fault, which lies 6,000 to 10,000 feet below the surface. Zone III is classified as a "Major damage" area and corresponds to probable maximum earthquake intensities of VII or higher on the Modified Mercalli scale. However, there have been no major earthquakes in the area since seismic records have been kept.

2.1.3.2 Physical. Each of the STC II sites has been evaluated with regard to access by unauthorized personnel who could cause disruption or operations or endanger the facility or personnel. The standard 60-acre configuration is enclosed by a security fence which surrounds the structures and antenna field. There are eight sites that do not utilize this standard configuration: Hill AFB, Buckley ANGB, Luke Site 1, Malmstrom Site 1, Cheyenne Mountain Complex Sites 1A and 1B, Duluth Site 1, and Hancock. For the latter six sites a security fence will enclose the same functional structures as in the standard configuration and a separate fence area will enclose the antenna field. The guard house(s) in both the standard and non-standard configurations will provide controlled entry for both service vehicles and personnel in accordance with required security procedures. The security threat considered here is associated with accessibility of the perimeter security fence under the assumption that normal entry is suitably controlled.

2.1.3.2.1 Luke Air Force Base, Arizona. Security at the sites at Luke AFB is examined below.

2.1.3.2.1.1 Site 1A. At this location, with the proposed land acquisition to the north of the current base boundary, public access exists along the entire length of the security fence. Litchfield Road is a county road which provides public access past the front of the building and to the street immediately to the south of the security fence. The remainder of the fenced area borders on public land and uncontrolled base housing areas. To provide the degree of security necessary, Litchfield Road should be closed to public access and the area to the east made a part of the controlled portion of the site.

2.1.3.2.1.2 Sites 1B and 1C. Relocation of the antenna field to Aux 1 or a nearby TBD location does not alleviate the less than ideal physical security of the main facility, as described in the preceeding paragraph. The security issues for the antenna field for Site 1C cannot be assessed until a candidate location is identified.

2.1.3.2.1.3 Site 2. An advantage of Site 2 (Auxiliary Field No. 1) is its relative remoteness. There are public lands approximately 1,000 feet to the north and east of the site, and under current conditions there would be nothing to deter access to the full perimeter of the security fence. If the access road to the site were controlled at a reasonable distance away from the site and a security fence installed between this point and the site, access

would be greatly reduced. Considerations should be given to enlarging the portion of the site that would be surrounded by the fence, to provide a larger security buffer zone.

2.1.3.2.2 Nellis Air Force Base, Nevada. The single site at this base is remote from normal public access. It is accessed by base roads which lie within the controlled area of the base. Good security control of the site could be accomplished by utilizing a control point on the access road near the site and enlarging the area surrounded by the security fence. The southern boundary of the site lies near the base boundary line; however, public access would require off-road vehicle transportation over several miles of rough terrain from the south.

2.1.3.2.3 Hill Air Force Base, Utah. The site lies wholly within the controlled area of the base, and public access is controlled by the base gate security function. The western portion of the site lies along the western base perimeter fence where public access could be attained adjacent to the railroad right-of-way; however, there is a buffer of about 400 feet to the essential operations areas. The site is relatively visible to the public from Interstate Highway 15.

2.1.3.2.4 Mountain Home Air Force Base, Idaho. The site is located entirely within the base boundary, which is presently fenced. The closest public access is from the north and east where perimeter fencing is over 1,000 feet from the site. Adjacent public areas consist of farmland without road improvements. The site is visible from the main gate to the northwest.

2.1.3.2.5 Malmstrom Air Force Base, Montana. Site 1 consists of structures wholly located within the controlled area of the base; the remote antenna field (Site 2) is also located within the controlled area. The closest public access is immediately south of the site on the U.S. Highway 87/89 right-of-way which is approximately 1,500 feet from the site. A ridge between Site 2 and the highway restricts visibility to the public.

2.1.3.2.6 Kirtland Air Force Base, New Mexico. The selected site is located within the base boundary, which is entirely fenced and patrolled by Base Security Police. Adjacent public areas to the south consist of undeveloped grazing land on the Isleta Indian Reservation. To the east is U.S. forest land which has been withdrawn from forest use and is utilized by Kirtland AFB and the Department of Energy (DOE) for military purposes. Access to the site is by way of Lovelace Road which is a controlled military road not open to the general public. There are no public highways or other publicly travelled roads in the vicinity of the site.

2.1.3.2.7 Buckley Air National Guard Base, Colorado. The selected site is located within the base boundary and is fenced with three and four-strand barbed wire, which is inadequate to assure physical security. The perimeter is patrolled by base security personnel. The site is bounded on the south by

a wildlife preserve, on the west by land zoned for residential development and on the east by privately-owned agricultural land which will probably be developed ultimately for residential purposes. Access to the site is by an unimproved perimeter road from the main base area approximately two miles to the north. Traffic on base is controlled at the main entry gate. Physical security at the site(s) would depend on facility fencing only, but as the adjacent residential development continues, improved base security fencing would be a necessity.

2.1.3.2.8 Peterson Air Force Base, Colorado. The selected site is located on federal property just outside the present base fencing along the northern edge of the base. This property currently is partially fenced; however, there is no utilization of the area at this time and it is uncontrolled. Peterson AFB is an open base with free public access except at night. If Peterson is selected for location of the proposed project, the base main gate would need to be moved northward near Highway 24. The site is bounded on the south by base housing, on the west by the main access road to the base, on the north by privately-owned industrial and residential land, and on the east by city-owned land which will serve as the approach area for a new north-south runway for the Colorado Springs Municipal Airport. Physical security of the site will be dependent on the facility security fencing and access control. If base boundary fencing is installed and if the base were to be closed to the general public, additional security to that provided by the facility fencing and controlled access would result.

2.1.3.2.9 Cheyenne Mountain Complex, Colorado. Physical access to the interior facility (Site 1) is highly secure due to the nature of the Cheyenne Mountain Complex mission; access to the exterior surface area is not as secure although the entire property line is fenced and under routine surveillance.

The antennas will be remotely located from the facility either at the summit of Cheyenne Mountain (Option A) or at Peterson AFB (Option B). In both cases, security must be provided at the antenna site and for the data transmission link to the facility. This problem is less severe for Site A because of the uninhabited rugged terrain, but for Site B the data link will have to cross densely populated areas and the antenna at Site B will require increased physical access control over that currently provided by Peterson personnel.

2.1.3.2.10. Offutt Air Force Base, Nebraska. The selected site is on the southeastern side of the base and is partially fenced at this time. The site is reached via an access road with a guard gate from a county highway. Because of the limited area available, there is no 1,000-foot buffer zone around the facility and the fenced area is adjacent to privately-owned land to the north. A recreational area and lake are located immediately across the county highway to the east. Adequate physical security will require constant patrolling of the area.

Military Uses of Space: 1946-1991

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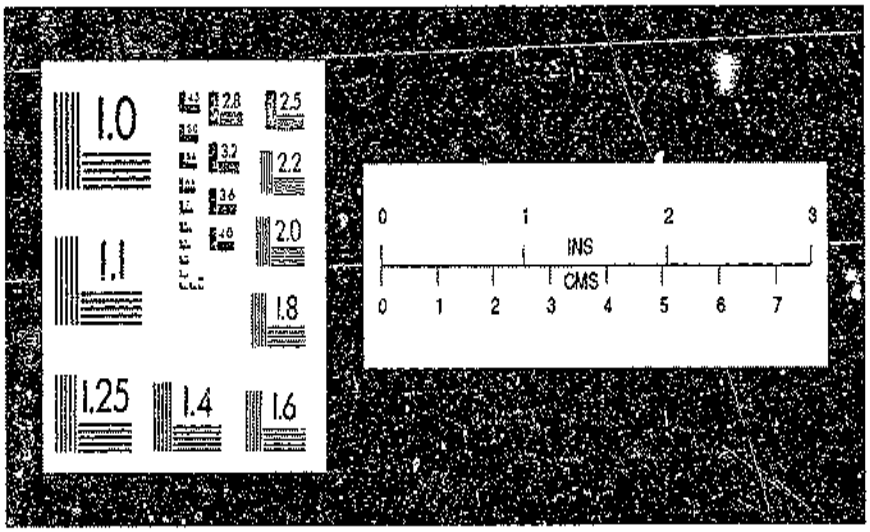

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2.1.3.2.11 Duluth International Airport, Minnesota. Physical access to Site 1, the SAGE building, is controlled by facility and base fencing and by guard houses on the base access road and adjacent to the building. The facility is located on 3 acres of land approximately 200 feet north of U.S. Highway 53 and is clearly visible to the public. Site 2 is on the northern side of the runways of Duluth International Airport approximately in the center of a 300-acre land area. It is presently unfenced, and construction of either the antennas alone or the entire facility must include fencing and access control on the approach road from the north. Taller buildings and antennas may be visible to the public from Martin Road, which is 0.2 miles to the north.

2.1.3.2.12 Hancock Field, New York. The facility and antenna locations are both located on base property which is only partially fenced. The base entrance roads have guard gates and are access-controlled. Both locations will require fencing and access control due to proximity to the base boundary, a nearby public road (Taft Road), city-owned land to the south, and other areas of the base in the vicinity of the site.

2.1.4 Real Estate. This section addresses the type and amount of land available at the candidate sites for the basic STC II facility. Growth considerations are discussed in paragraph 2.1.6. (U)

2.1.4.1 Land Type. Both Luke AFB Site 1A and Cheyenne Mountain Complex Site 1A have a serious deficiency. Privately owned land, in the amount of approximately 85 acres at Luke and a minimum of 30 acres at Cheyenne Mountain, will have to be acquired to accommodate the antenna field. This could be an expensive and time-consuming process. Depending upon its selected location, a similar problem could exist for Site 1C antenna field at Luke AFB. In the case of the Cheyenne Mountain Complex Site 1A, private radio/TV broadcast towers are presently erected on the site. These towers would have to be relocated to provide adequate space for the STC II antennas. Certain warehouse buildings and the employee parking lot for the proposed project at Site 1 of Duluth International Airport are planned for construction on land presently leased by the government until the year 2013. The Luke AFB Auxiliary Field #1 (Sites 1B and 2) is on land leased to the government by the State of Arizona. Neither of these situations merit concern, because it is expected that the leases can be extended indefinitely or the land can be acquired (or reacquired) by the federal government. All other candidate sites are located on federal (Air Force) property.

5.1.4.2 Land Availability. All sites except one appear to have sufficient space to accommodate the basic STC II facility, although several sites (as discussed in Sections 2.1.2.3 and 2.1.3.2) provide inadequate buffer zones for safety and security. The exception is the Cheyenne Mountain Complex, where existing floor space is inadequate to meet the basic requirements of the STC II. It will be necessary to excavate additional tunnels/compartments within the mountain in order that approximately 55,000 square feet of new building floor space can be constructed. This work will be extremely costly to accomplish. Further, the preparation of the antenna field with antenna pedestals and radomes on top of Cheyenne Mountain (Site 1A) will be very difficult.

The area is presently mainly rugged rock-hard mountainous terrain with few flat areas. The road to the antenna site starts in the foothills approximately six miles (by road) to the north of the complex entrance and then traverses a rugged zig-zag circuitous mountainous route of some nine or ten miles to the antenna site. The cost of this project is estimated to be extremely high. Cost data is presented in Section 2.4.1. Sites that involve locating the antenna field away from the technical building -- Luke AFB Sites 1B and 1C, Malmstrom AFB Site 1, Cheyenne Mountain Complex Site 1B, and Duluth Site 1 -- will possibly involve the need to acquire right-of-ways for installation of communication data links over lands not federally owned. Removal of several temporary buildings in the vicinity of Malmstrom Site 1, as baselined in the current Base Master Plan, would provide adequate space for STC II. Also, individual antennas would be remoted east of the runway at Buckley ANGB, approximately 4500 feet from the technical building.

2.1.5 Future Communications. This section addresses one of the principal growth-related objectives for STC II: ability to transmit and receive K-band and laser communications frequencies. This requires (1) a clear, dry climate to minimize signal attenuation and (2) location in an area secure from electronic threats such as jamming and eavesdropping. The second criterion is primarily a function of geography and was considered prior to the site survey; it is therefore treated only briefly below.

2.1.5.1 Climate. The principal meteorological parameters affecting signal strength and attenuation are air mass humidity, cloud thickness, and rainfall rate and amount along the signal path distance. Although precise upper atmospheric data for these parameters are not available for specific locations from long-term records, their effects on signal attenuation can be roughly inferred from surface observations for the purpose of judging the relative merits of potential sites from a meteorological viewpoint. Figures 2-1 and 2-2 present the monthly mean values of relative humidity and rain for each site. Table 2-2 provides the total number of hours, expected during the year for each station, for rainfall rates exceeding 0.25, 1.00, and 2.00 inches per hour. Cloud thickness is discussed in narrative form as part of the overall cloud climatology for each station. The climatological data presented is designed to furnish information on prevailing weather conditions at each location in an effort to delineate the most favorable geographic region for STC II site selection.

2.1.5.1.2 The primary purpose of the cloud climatology is to provide information on the probability with which cloud free line-of-sight transmissions can be expected for various elevation angles, summed over all quadrants. Figure 2-3 (Percent Probability of Cloud Free Line-of-Sight) is of importance in millimeter RF communications (SCDRS) or laser communications and represents a measure of the probability of occurrence of an unobstructed viewing field of a satellite. It is supplemented in narrative form by site peculiar cloud conditions that prevail over geographic landmarks (primarily mountain ranges) during certain seasons of the year. Since fog and other visibility restricting phenomena fall into the broad category of RF path transmission obstructions, they are included in the discussion.

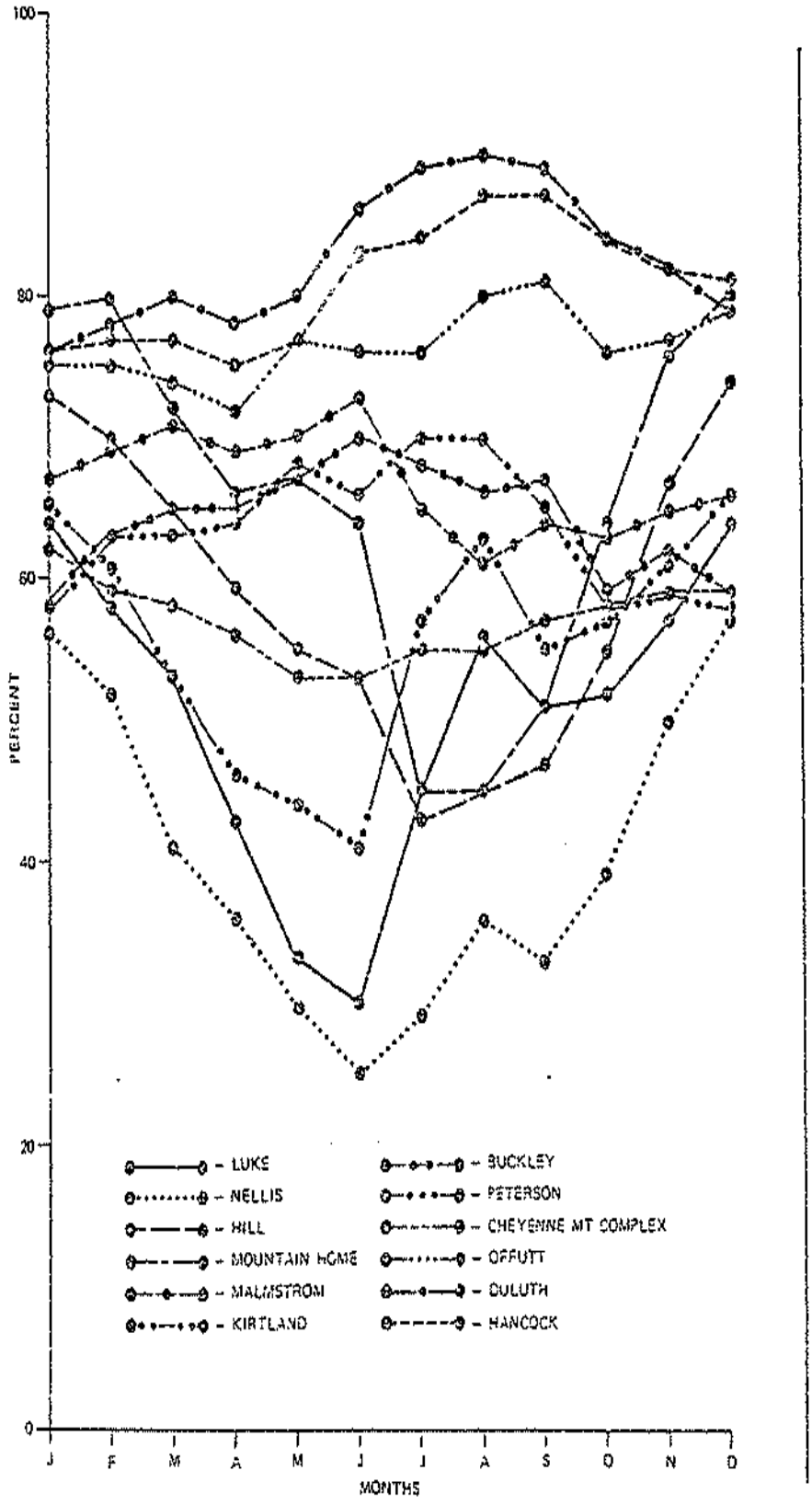


Figure 2-1 Percent Mean Relative Humidity (High)

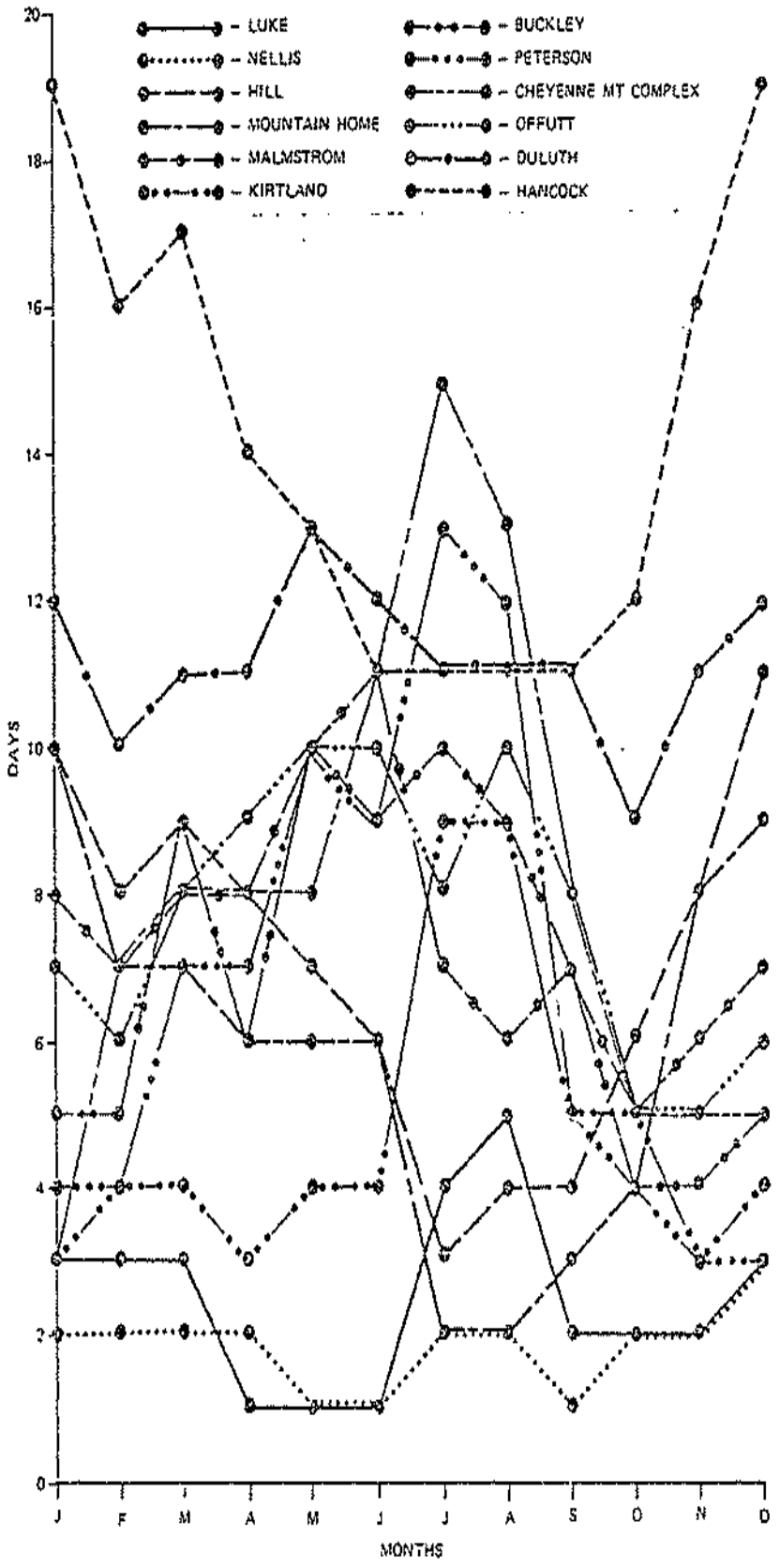


Figure 2-2 Mean Number of Days Rainfall Exceeds 0.01 Inches

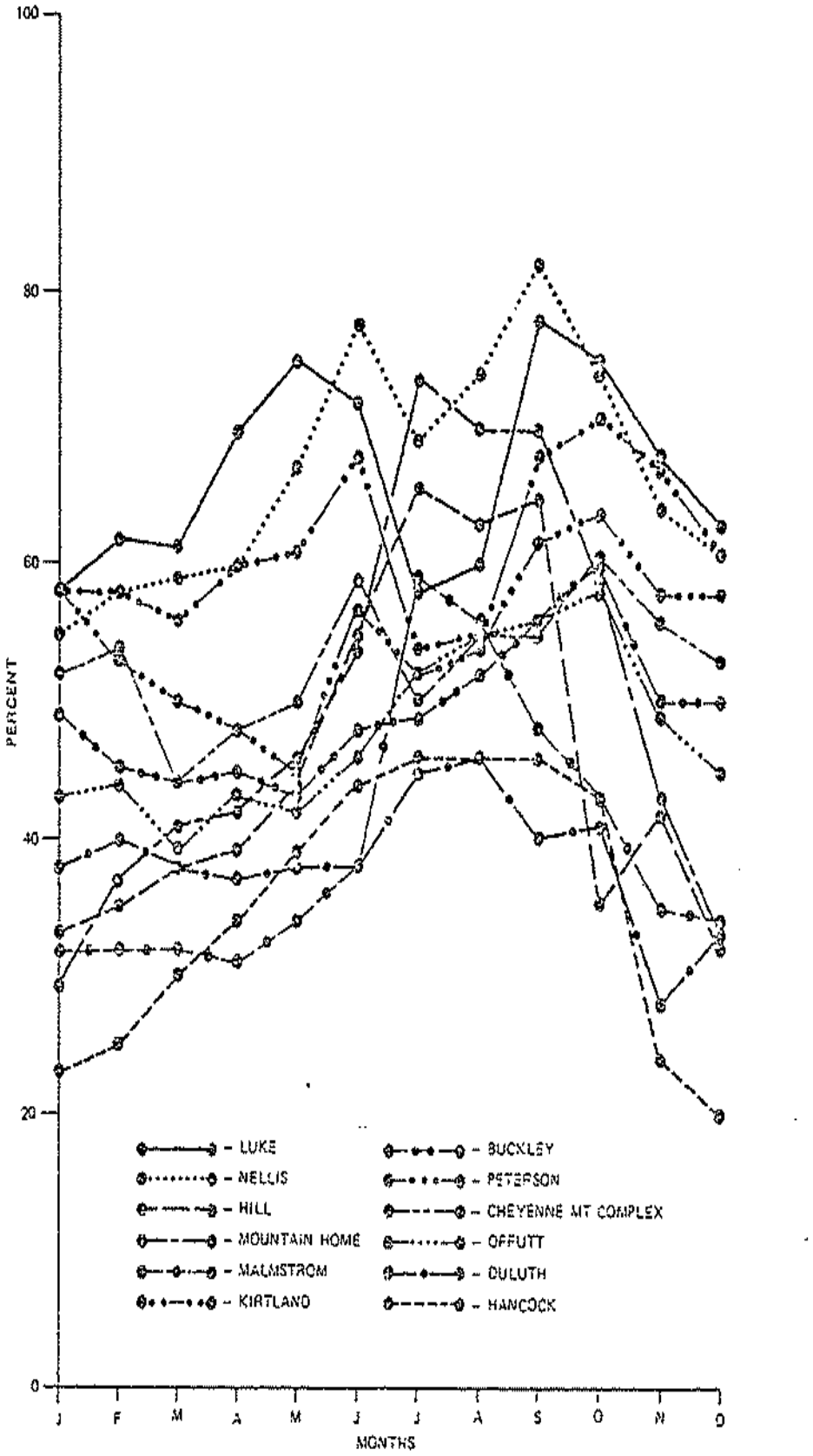


Figure 2-3 Percent Probability of Cloud-Free Line-of-Sight at 10° Elevation Viewing Angle

Table 2-2 Hours of Moderate/Heavy Rainfall

Location	Rainfall - Number of Hours - Annual		
	At Rainfall Rate in Inches Per Hour		
	≥0.25	≥1.00	≥2.00
Luke AFB	4.55	0.57	0.14
Nellis AFB	2.60	0.39	0.13
Hill AFB	3.52	0.72	0.12
Mountain Home AFB	6.20	0.50	0.09
Malmstrom AFB	9.41	0.81	0.14
Kirtland AFB	5.38	0.66	0.16
Buckley ANGB	10.23	1.28	0.35
Peterson AFB	10.18	1.55	0.48
Cheyenne Mt. Complex	15.32	2.23	0.69
Offutt AFB	20.95	3.05	0.89
Duluth IAP	23.83	4.51	1.55
Hancock Field	25.78	3.25	0.89

NOTE: Each entry is the estimated average annual hours when the specific rainfall rate (over a one minute interval) is equaled or exceeded.

2.1.5.1.3 Any form of moisture content in the line-of-sight between a satellite and its ground support antenna causes significant attenuation to high frequency (millimeter wave) RF signals. Ground transmitted power can be increased to reduce these effects on uplink transmissions. However, this cannot be done on downlink transmissions since transmitted power is limited by available satellite power and the antenna size is constrained by surface accuracy, weight, and mass considerations. Thus, it is extremely important that the facility be located in an area where weather attenuation effects to satellite downlink signals is minimized. Figures 2-1 through 2-3 show that the candidate sites at Luke AFB and Nellis AFB have meteorological conditions that minimize attenuation effects to the Satellite Control and Data Relay System (SCDRS). Table 2-2 also demonstrates the favorable rainfall conditions of these two locations in southwest CONUS.

2.1.5.1.4 In addition to rainfall, the amount of cloud cover and its persistence is a major factor in determining availability of millimeter RF or laser communications links. Data representing clear sky conditions and cloud cover for the locations of interest are shown graphically in Figures 2-4 and 2-5. This information was compiled from observations made every three hours over a three year period at each of the candidate sites. Cloud cover conditions were categorized as clear (less than 35%), partly cloudy (35% to 65%), or cloudy (more than 65%); however, data for the partly cloudy condition are not shown. The ordinate on both figures should be interpreted as the probability that the sky condition will not change significantly for the time shown on the abscissa. The evaluation of cloud thickness involves several meteorological factors which were included in data gathered from individual bases. These factors included cloud cover data, frontal storm occurrence, weather stagnation characteristics, cloud buildup locations and elevations, and fog occurrence. This data is partially quantitive, but somewhat subjective in nature. It was obtained through discussions with base meteorologists or from summary data documented by the bases in advance of the survey. Each base is discussed separately below:

2.1.5.1.4.1 Luke Air Force Base, Arizona. Fog can be expected several times during the January through March period with visibilities less than one mile. Thunderstorms occur occasionally in April in conjunction with frontal or trough passage. Average frequency of storms increases greatly by late June and can occur anytime in July through September lasting 24 hours maximum. Storms are rare during October through December. Cloud tops with storms vary from 6,000 feet to over 55,000 feet. There is some weather stagnation associated with storms with a 24-hour typical duration. In July through mid-September, scattered cloud buildup occurs with tops between 35,000 and 40,000 feet on 50% of the afternoons.

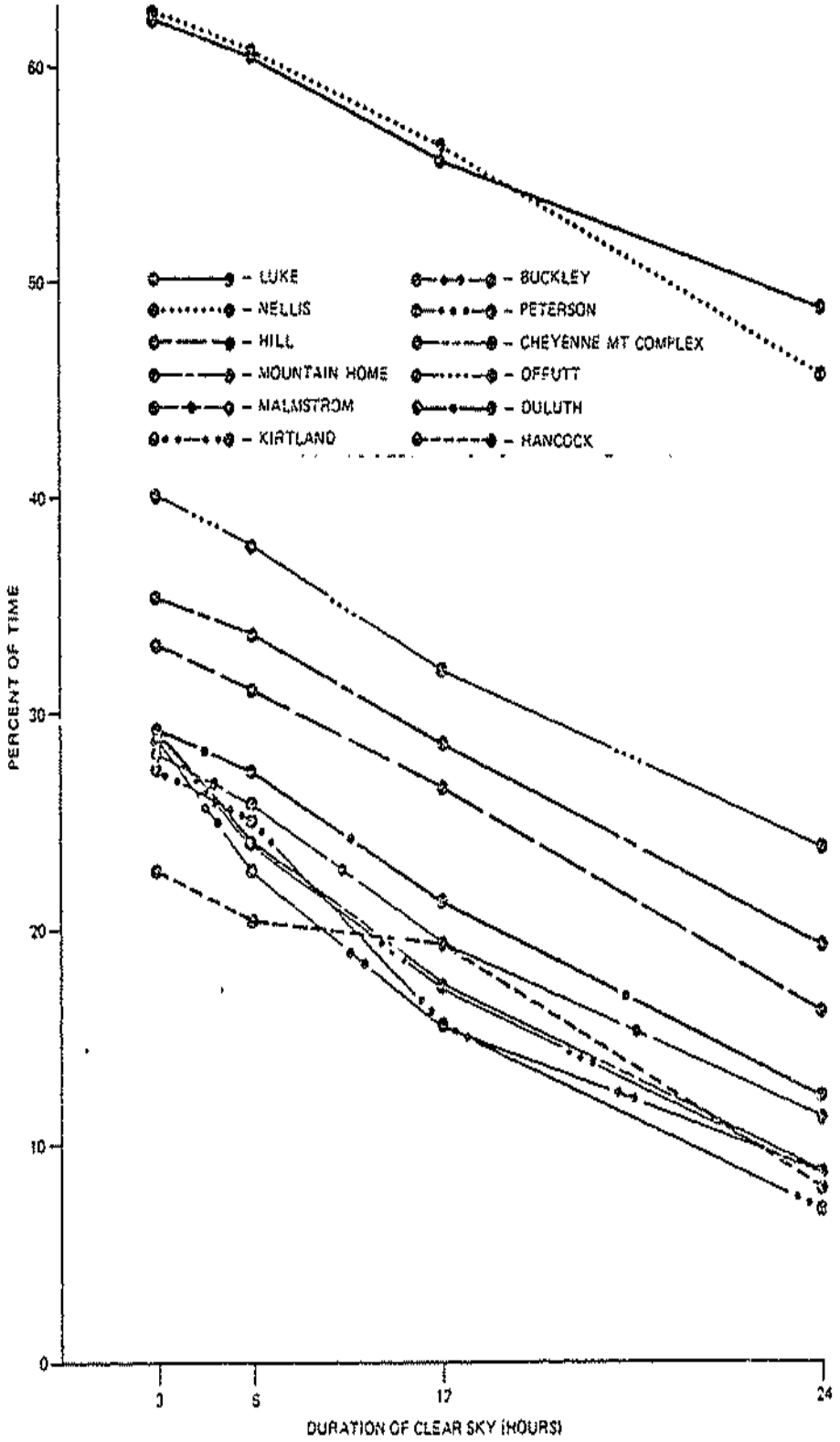


Figure 2-4 Clear Sky Conditions, Yearly Averages

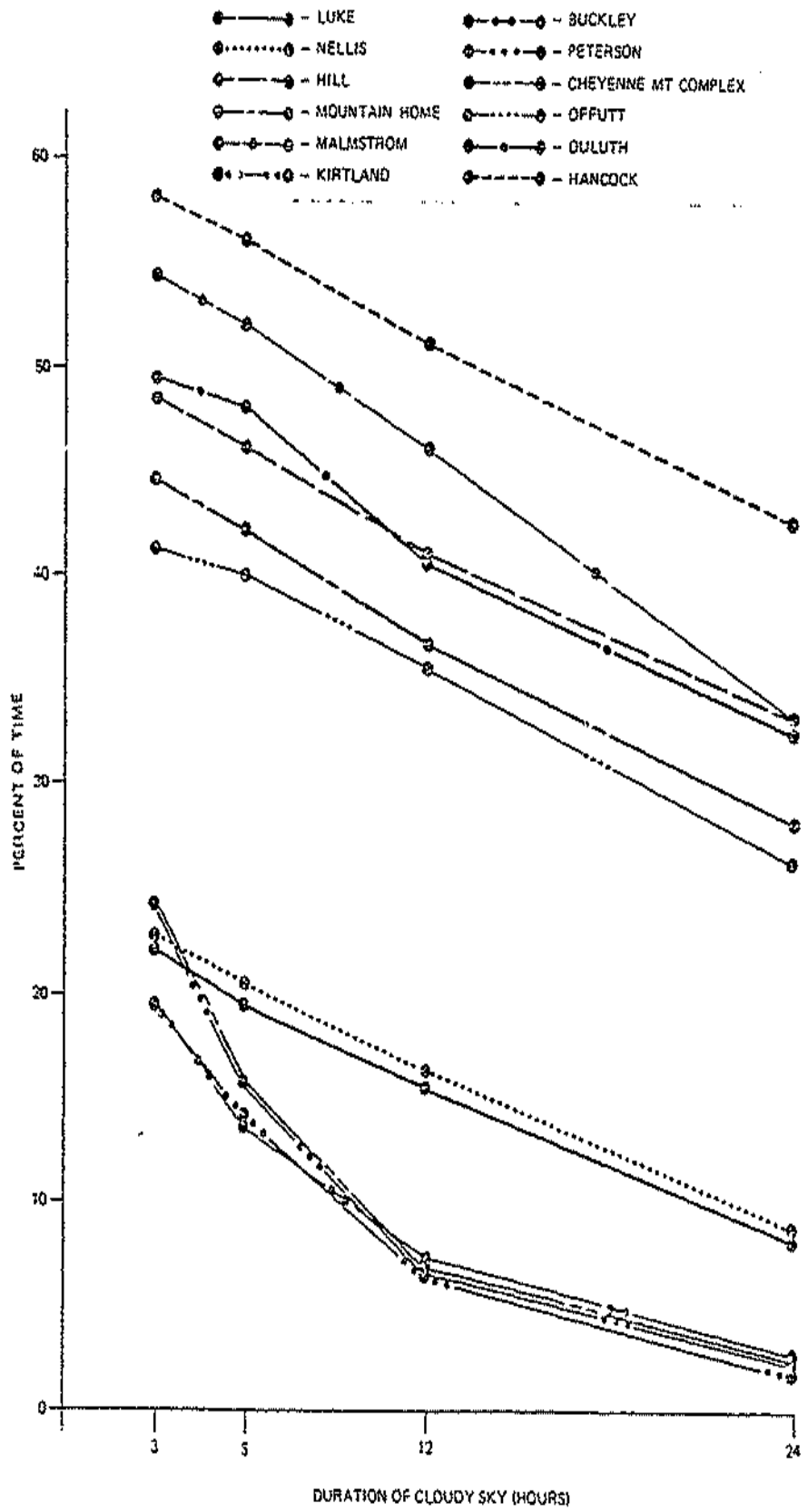


Figure 2-5 Cloudy Sky Conditions, Yearly Averages

2.1.5.1.4.2 Nellis Air Force Base, Nevada. Frontal storms occur during winter and early spring at a frequency of once every 7 to 10 days; during the summer and fall this frequency drops to one in 10 to 15 days. There are two to four weeks in the summer where conditions favor stagnation. Cloud buildup associated with storms is up to 40,000 feet. The tops generally block 10 deg to 12 deg above the horizon in the Spring Mountains (bearing 220 deg through 300 deg). Rainshowers occur approximately 10% of the time in these mountains during the summer, and 8% of the time in the Sheep Mountains (bearing 320 deg to 355 deg).

2.1.5.1.4.3 Hill Air Force Base, Utah. Monthly means on sky cover vary from 3.2 tenths to 6.9 tenths, the latter occurring in January. The next higher months are February (6.6), March (6.3), April (6.2), November (5.8), and May (5.6). Other monthly means are less than 4.5 tenths. Frontal storms occur most frequently in winter and spring with an average of 6 in January and 6 in February, seldom lasting more than 8 hours. There is some tendency for stagnation, especially in winter. It is usually associated with cloud buildup over the mountains and inversion, resulting in smog/haze and sustained cloud formations and showers. Most cloud buildup is over the mountains from NE to SW with maximum buildup during storms up to 40,000 feet.

2.1.5.1.4.4 Mountain Home Air Force Base, Idaho. Cloud cover varies from a mean of 2.4 tenths in July to 7.2 tenths in January. Other relatively high months are December (6.9), February (6.3), March (6.0), April (5.8), May (5.4), and June (4.5). At 20,000 feet elevation the percentage frequency for visibilities greater than or equal to zero ranges from 43.5 in January to 88.4 in July. Other low frequency months are December (47.1), February (54.0), November (57.6), and March (58.8). Surface visibilities greater than or equal to zero range from 97.7 to 100%. There are about two thunderstorms per month from April through October, with as many as five in July. Storms frequently stagnate and produce rain for one or two days. Some fog occurs during winter months lasting two to three days -- but up to 10 days maximum. Cloud buildup is between 180 deg to 270 deg with a maximum elevation of 40,000 feet at 35 miles.

2.1.5.1.4.5 Malmstrom Air Force Base, Montana. Average cloud cover varies from 49% (summer) to 69% (spring). The winter cloud cover is also high at 68%. The most frequent azimuth for cloud buildup is SE through W in mountain ranges. The average cloud cover for the year is 61% with high averages occurring in January through April, May, November, and December. Pacific frontal storms average one every six days in late fall and early spring. Arctic frontal storms occur about three times per month from December through February and two times per month in November, March, and April. Weather stagnation occurs in June lasting two to five days; in fall and spring stagnation can result in heavy precipitation for two-day periods. In summer cloud tops range from 8 deg to 15 deg elevations to the SW and W with heights up to 35,000 feet.

2.1.5.1.4.6 Kirtland Air Force Base, New Mexico. Frontal activity is generally confined to winter months with frontal passage about every five days. Prolonged periods of heavy cloud cover and precipitation are practically unknown as fronts and pressure systems that affect the area tend to move rapidly. System stagnations are rare. Snowfall is concentrated between November and March with heaviest snowfalls most likely in December. Winter storms producing an inch or more of snow are only likely about four times per year. The wettest period is May through October with August being the wettest month. Thunderstorms are most active in July and August when a thunderstorm can be expected every three days. Buildups can be expected daily. Thunderstorm tops typically reach 40,000 feet. Fog occurrences are negligible.

2.1.5.1.4.7 Buckley Air National Guard Base, Colorado. The frequency of frontal passage in this area ranges from one every three days in winter to one every six days in summer. The weaker summer fronts may be nearly void of cloud. Fronts and pressure systems tend not to stagnate in this vicinity. Moist northeast upslope winds do produce a persistent low stratus deck about 6,000 feet thick which may last up to 24 hours. Snowfall is concentrated between November and April with heaviest snows expected in March. Wettest months are March through September with June being the wettest month. Thunderstorms are at a maximum June through August with about one in every three days being a thunderstorm day. Buildups can be expected daily through these months. Typical thunderstorm tops reach 40,000 feet. Fog occurrences are found throughout the year but are maximum in March.

2.1.5.1.4.8 Peterson Air Force Base, Colorado. Fronts are most active in this area during winter months with a frontal passage every three to four days. Frontal activity in summer is nearly non-existent. Generally fronts and pressure systems do not stagnate in this area. Moist southeast upslope winds produce persistent low stratus decks up to 2,000 feet thick and lasting typically up to 24 hours. Snowfall is concentrated from November through April with heaviest snowfalls likely in March and April. The wettest months are April through October with July being the wettest month. Thunderstorms are most active May through August with a thunderstorm expected once every two to three days in July and August. Buildups can be expected daily. Typical thunderstorms have bases at 6,000 feet and tops to 40,000 feet. Fog occurrences are uniformly distributed through the year with peak occurrence in March.

2.1.5.1.4.9 Cheyenne Mountain Complex, Colorado. Cheyenne Mountain and Peterson Air Force Base are both in the same climate zone. As such, the weather patterns discussed in the previous paragraph are also applicable here. When the mountain top elevation is considered, there are some notable exceptions which are discussed here. Cheyenne Mountain's peak will be above the thick stratus cloud decks caused by the upslope winds; however, during frontal passage the peak is likely to be embedded in cloud. Precipitation will follow the same pattern as that for Peterson AFB but amounts will be greater on the mountain. As with the low cloud decks mentioned above, the mountain peak will be above any fog decks.

2.1.5.1.4.10 Offutt Air Force Base, Nebraska. Fronts are active in this area throughout the year. Fronts pass through the Offutt area about once every two to three days during winter and every four to five days in summer. There are occasional frontal stagnations lasting up to 18 hours. Pre-warm frontal fog may affect the area for up to 36 hours. Such fog extends up into the cloud base whose tops extend typically to 10,000 feet. Snowfalls are fairly uniform in December through March, with January and February appearing to be more favorable for heavier snowfalls. April through September are the wet months, with the wettest months being May and June. Thunderstorms are most active between May and August. During June, July, and August every third day is a thunderstorm day. Typical thunderstorm bases are 3,500 feet with tops to 40,000 feet. Fog occurrences are distributed throughout the year but most frequently during December through March.

2.1.5.1.4.11 Duluth International Airport, Minnesota. Fronts are active in the Duluth area throughout the year. During winter, fronts pass Duluth once per four days, while in summer once per fifteen days. Fronts and low pressure systems tend to move rapidly through the area and rarely stagnate. Snowfall is fairly uniformly distributed from November through March. Heaviest snowfalls occur in December, January, and March. Although rainfall is rather evenly distributed, the period May through September is the wettest period. Thunderstorms are most frequent in June, July, and August; however, the three months only total 22 thunderstorm days between them. Typical thunderstorm bases are 1,500 feet and tops 40,000 feet. Fog is a year-round feature, totaling 122 days per year with August and September being high incidence months.

2.1.5.1.4.12 Hancock Field, New York. Fronts pass through this area about once every three days year-round; however, there is a marked difference in frontal intensity and weather with changes of season. There are occasional frontal stagnations up to two days in the area but most fronts and pressure systems move through rapidly. Snowfall is concentrated between October and March, with heaviest snowfalls expected in December, January, and February. There is no distinct wet weason; however, August is the wettest month. June, July, and August are the active thunderstorm days. Typical thunderstorm bases are 2,000 feet with tops to 25,000 feet. Fog occurrences can be expected throughout the year but most frequently in December through February.

2.1.5.2 Electronic Threat. All candidate installations, except Duluth IAP and Hancock Field, are "de facto" electronically secure from interference or eaves-dropping because of their locations: at least 75 miles from international borders or 125 miles from the nearest sea coast. These distances were determined to be adequate based upon a SAMSO/IN threat assessment performed with respect to technologies expected to be available in the mid-1980s.

2.1.5.2.1 Ships from Communist-Bloc nations use the Port of Duluth during the warmer months when the waterways thaw. Such ships also dock at Port Oswego, NY, less than 25 miles from Hancock Field, and regularly transit Lake Ontario. Intelligence units report that many of these vessels carry electronic sensors, and, accordingly, both Duluth IAP and Hancock Field are subject to this threat. Mobile or covert threats could theoretically be

deployed in the vicinity of all the candidate sites; however, it is assumed that such overt threats would soon be detected and physically negated.

2.1.6 Future Expansion. This section addresses a second growth objective: additional land immediately adjacent to the STC II site. The candidate sites identified on the various bases provide adequate growth capability with the following exceptions - Sites 1 at Luke AFB, Malmstrom AFB, and Duluth IAP and the sites at Hill AFB, Buckley ANGB, Peterson AFB, Cheyenne Mountain Complex, Offutt AFB and Hancock Field. The former three sites are associated with SAGE facilities located in built-up areas of the bases. The latter six sites are constrained for the reasons discussed in the subparagraphs below.

2.1.6.1 Luke AFB. Site 1 is surrounded on three sides with base housing, recreational areas, the base hospital, and a public road separating the facility from support buildings on the main base. On the north side there is a large, open storm drain approximately dividing the available land (24 acres). To provide room for the Site 1A antenna field and a safety buffer zone -- to protect from future high rise development and encroachment into the antenna beam -- agricultural land would have to be procured. (This safety buffer zone is required to provide adequate protection from the radiated energy while the antenna beam is close to the ground. Analysis has indicated that a 1,000 foot buffer provides sufficient protection.) Little growth potential exists with the proposed Site 1A layout, because of the close proximity of the approach end of the runway and/or future environmental constraints around the hospital and civilian housing area. These concerns apply equally to expansion of STC II facilities at Sites 1B and 1C, but not to expansion of the Aux 1 remote antenna field (1B) nor, if properly sited. the nearby antenna field (1C).

2.1.6.2 Malmstrom AFB. The SAGE facility is located in the heart of the base industrial and office building area. In order to supplement the SAGE floor space to meet minimum STC II requirements without SOPC, temporary buildings would have to be removed. Removal of these buildings is included in the present Base Master Plan. Future growth around the SAGE facility, however, could be accommodated only by removal of additional buildings.

2.1.6.3 Hill AFB. Ordnance storage areas are located to the north and east of the site. There is an extensive warehouse complex just to the south. The base boundary, railroad tracks, and a major interstate highway delineate the western perimeter. Expansion of the basic STC II facility might require closure of the ordnance storage areas or otherwise impact existing base activities.

2.1.6.4 Buckley ANGB. The site is bounded by the main runway to the east, a wildlife preserve to the south, private land undergoing development to the west, and a firing range to the north. Even if the range were moved, STC II expansion in that direction would be difficult because the terrain becomes (a) steep, making construction expensive, and (b) lower than that to the west, where residential development is in progress. This would increase potential EMR hazards to the public.

2.1.6.5 Peterson AFB. Base housing areas are located south of the site. Just beyond the base boundary along the northern border of the site are a U.S. highway, a state highway, and an interchange. Land immediately to the east is city-owned, in anticipation of development to the southeast of an additional runway for the municipal airport. West of the site, across the entrance road to the base, is a small parcel of recently-acquired base property, itself bounded on the west by city sewage treatment lagoons. Only to the east, thus, is there enough physical space for additional facilities, antennas, and necessary safety and security buffers. This area is neither on base nor federal property, however, and its use for STC II-like operations appears imcompatible with its future status as an approach zone for a major commercial runway.

2.1.6.6 Cheyenne Mountain Complex. There are two siting options considered at Cheyenne Mountain; both rely on using the existing NORAD facility inside the mountain for technical, engineering/administrative and other support functions. The existing total building structures in the interior of the mountain contain 246,000 square feet of floor space, but minimum requirements of the STC II facility (determined by those functions which must be housed together) are 306,000 sq ft. In order to achieve the extra floor space needed, additional tunneling in the mountain will be required. While there are no apparent geological reasons which would prohibit enlargement of the interior facilities, it is obvious that a significant expense would be incurred over that of merely constructing additional buildings. Some of the support functions can be located outside of the mountain (an additional 25,000 sq ft of floor space), and there appears to be adequate buildable area for any foreseeable expansion of such support functions. The Site 1A alternative involves location of the antenna field on top of Cheyenne Mountain on a semi-flat mesa (approximately 29 acres in size) situated above the 9,400 foot elevation contour. While this acreage is sufficient for the initial STC II facility, siting of additional antennas would be severely constrained by the rugged and excessively steep terrain below the 9,400 foot contour.

2.1.6.6.1 The second alternative (Site 1B) would rely on remotely locating the antennas at Peterson AFB in the northeast corner, on a level parcel of land about 110 acres in size. This location offers considerable area for installation of additional antennas; nevertheless, the alternative relies on the technical and other administrative/engineering and support functions being located inside Cheyenne Mountain (where expansion of floor space requires expensive tunneling) and it lacks a 1000 ft buffer area.

2.1.6.7 Offutt AFB. The selected site is a 90-acre triangular parcel bordered on the north by privately-owned property planned for an industrial park, and on the east by a County public road and an adjoining recreation lake which is owned and operated by the base. The main runway for flight operations at Offutt borders the site on the third side of the triangular parcel. Future growth beyond the 90 acres would require either purchase of the off-base property to the north, or relocation of the public road and drainage of the lake. These options would permit expansion to the north and east; relocation of the runway to permit expansion to the southwest is not considered a viable alternative.

2.1.6.8 Duluth IAP. Site 1 relies on using the existing SAGE facility for the technical, engineering/administrative and support functions. It is a four-story structure containing 90,000 square feet of floor space. U.S. Highway 53 adjoins the SAGE building on the south; property on the east is privately-owned and is presently undeveloped. Base property to the north and west is used primarily for parking for SAGE employees. The minimum floor space required for the basic STC II facility cannot be met by the present SAGE building and additional structures would have to be constructed on land adjoining the SAGE facility. Future expansion beyond the basic STC II facility would appear to be extremely limited due to the lack of available land for this purpose.

2.1.6.9 Hancock Field. Facility siting at Hancock Field utilizes the existing SAGE buildings and remote location of the antennas at another on-base site. The SAGE facility has limited growth potential because it is surrounded by base facilities and roads on the south, west and east, and by privately-owned off-base property to the north. The remote antenna field is a 24-acre site located on base property 750 feet southeast of the SAGE facility. To the west of this site is a large undeveloped area where the Base Commander's 175-year old home is located. The base boundary is about 400 feet to the south and the main airport runway is 2500 feet beyond that. Watertown Road (the main interior road on the base) adjoins the site on the east. Future expansion of the antenna field would probably be feasible to the west, but would require removal of the 175-year old structure; expansion to the south, east and north would be limited by virtue of the base boundary, the existing runway, Watertown Road, and other existing base facilities.

2.1.7 Resource Utilization. This section addresses two criteria for which site evaluation is straightforward: location on or near an active Air Force base and availability of existing facilities, e.g., SAGE buildings, which could be modified for the project.

2.1.7.1 Active Base. All sites are located on major Air Force (or Air National Guard) installations except Luke AFB Sites 1B, 1C, and 2. Base services are considered available for all sites, but at the three Luke sites listed, certain operational support capabilities would have to be added, such as access roads, utilities, fire fighting equipment, etc. It should be noted that many support services for Buckley ANGB are provided by Lowry AFB, and those for the Cheyenne Mountain Complex are provided by nearby Peterson AFB. Further details on base support services are discussed in paragraph 2.3. Cost data for the sites, including the additional operational support capabilities, are presented in paragraph 2.4.

2.1.7.2 Existing Facilities. SAGE facilities are available at Luke AFB Site 1, Malmstrom AFB Site 1, Duluth IAP Site 1, and Hancock Field. No suitable existing technical facilities are available at any of the other sites, with the exception of the interior buildings at Cheyenne Mountain and the Manzano facility at Kirtland AFB. The Manzano Base complex is located several miles from the proposed site and includes a theater, gym, chapel, and three dormitories which could possibly be renovated for administrative or support use. The cost aspects of SAGE vs non-SAGE sites are addressed in paragraph 2.4.

2.1.8 Local Support. This section addressed desirable amenities which could be provided by local communities in the area of each candidate site, such as a pool of technically trained personnel, cultural and educational facilities, airport service, recreation, etc. Although many of these issues are discussed in greater detail in paragraph 2.2, Environmental Impact, certain general observations are made below.

2.1.8.1 Community Facilities. Sites at Luke, Nellis, Hill, Kirtland, Buckley, Peterson, Cheyenne Mountain Complex, Offutt, Duluth and Hancock Field are located near major metropolitan areas with extensive civilian facilities. Malmstrom is located in a moderate-sized community, where facilities are considered adequate, though not extensive. The civilian community at Mountain Home is very small and cannot provide adequate off-base support. Boise, a medium-sized metropolitan area with adequate facilities, is 56 miles away, which is considered unacceptably far. Duluth IAP is located in a region of a highly stable population with very little new development occurring in the area. The proposed project will generate an immediate need for new housing to handle the additional employees and their families. It is anticipated that the Duluth community will respond to such demands on their resources, however, close liaison with local officials will be required to minimize the impact.

2.1.8.2 Airport Services. Sites at Luke, Nellis, Hill, Buckley, and Offutt are within 50 miles of major airports with frequent direct service to San Francisco/San Jose, Los Angeles, and Washington, D.C. Sites at Kirtland, Peterson, Cheyenne Mountain Complex and Offutt are close to commercial airports with acceptable service frequencies, although connections via Denver are required for many Colorado Springs and Omaha flights. The Malmstrom site is convenient to the Great Falls airport; however, service to the locations of interest is poor. The nearest commercial airport to Mountain Home is located at Boise, more than 50 miles away, and the service is marginal. Only one commercial airline serves Duluth; infrequent connections for San Francisco/San Jose, Los Angeles, and Washington D.C., are available via Chicago, Denver, and Minneapolis/St. Paul. Air travel is provided from the Syracuse-Hancock International Airport with direct flights to many East coast cities including Washington D.C.; however, flights to San Francisco/San Jose, and Los Angeles are via Chicago and/or Dallas.

2.2 Environmental Impact. The environmental assessment involved gathering detailed data on the physical, biological and socioeconomic factors for each of the twelve prospective bases and for the specific sites on each base. This data was utilized to identify significant adverse or beneficial environmental impacts which would result from the construction and operation of the facility at each location, and to provide an input to the site selection process. The environmental factors considered were categorized as either physical, biological, or socioeconomic. The physical and biological factors considered were:

a. Electromagnetic Radiation

b. Water Resources

c. Biologic Resources (Flora/Fauna)

d. Geology and Landforms

e. Air Quality

f. Meteorology

g. Noise

h. Cultural Resources (Archaeological, Paleontological, Historical)

i. Land Use

j. Utility Services

k. Visual and Aesthetic Considerations

The socioeconomic factors considered were:

a. Base/Community Interface

b. Demographic Data

c. Public Services

d. Housing

e. Education

f. Health Services

g. Transportation Systems

h. Recreational Facilities

i. Cultural Facilities

j. Employment

To assist in obtaining the appropriate environmental data, checklists were used which contained the factors of concern including the related sub-elements of those factors. The only community-generated data collected was that made available by base personnel. It should be noted that community data and attitudes are essential ingredients of the Candidate Environmental Impact Analysis Process and will be further investigated after the tentative site selection has been made. Data analysis consisted of identifying the significant environmental impacts (both positive and negative) at each base and performing more detailed analysis for those factors. Since in most cases the specific sites are on existing bases where other military activities are being conducted, many of the environmental factors should have minimal impact. The next three sections discuss the general environmental impacts; specific base-related discussion begins with paragraph 2.2.4.

2.2.1 Electromagnetic Radiation (EMR). Safety considerations require careful analysis of the expected EMR environment at each site. The radiation power density limit for personnel used for survey purposes was 0.1 milliwatts per centimeter squared (mw/cm^2). This limit is two orders of magnitude below the current OSHA standard (10 mw/cm^2) and was chosen because the latter is likely to be lowered in the near future. The radiation power density limit for electro-explosive devices (EEDs) is frequency- and configuration-dependent. Potential hazards to personnel and EEDs are addressed separately below.

2.2.1.1 Potential Personnel Hazard. No hazard to personnel exists at any of the surveyed sites for normal or peak power operation of the STC II antennas. This conclusion applies to personnel working within STC II buildings or nearby structures on the base and to personnel working on the ground outside the fenced antenna area. EMR levels within the fenced antenna area are potentially hazardous because of back and side lobes, radiation reflected from other structures, and the existence of multiple transmitters. For these reasons, this area warrants strict access control until actual field measurements are made. Site-peculiar observations regarding personnel EMR exposure may be found starting in paragraph 2.2.4

2.2.1.2 Potential EED Hazard. Power density thresholds for EEDs and the radiation levels produced by STC II antennas are tabulated in Table 2-3. The table also indicates the maximum distance out to which the "hazard zone" extends. Four conclusions can be drawn from this data:

a. No EED hazard exists for normal power operation of the STC II antennas.

b. An EED hazard exists to aircraft in landing configuration when a SCDRS, DSCS, or DLT antenna is operating in its peak power mode.

c. An EED hazard exists to aircraft in a gear-up configuration carrying internal or external EED's when the SCDRS antenna is operating in its peak power mode.

d. The EED hazard presented by the SCDRS and DSCS antennas (at peak power) extends out a considerable distance from the antenna field, although it is confined to certain azimuth/elevation sectors. These sectors are depicted in Figure 2-6.

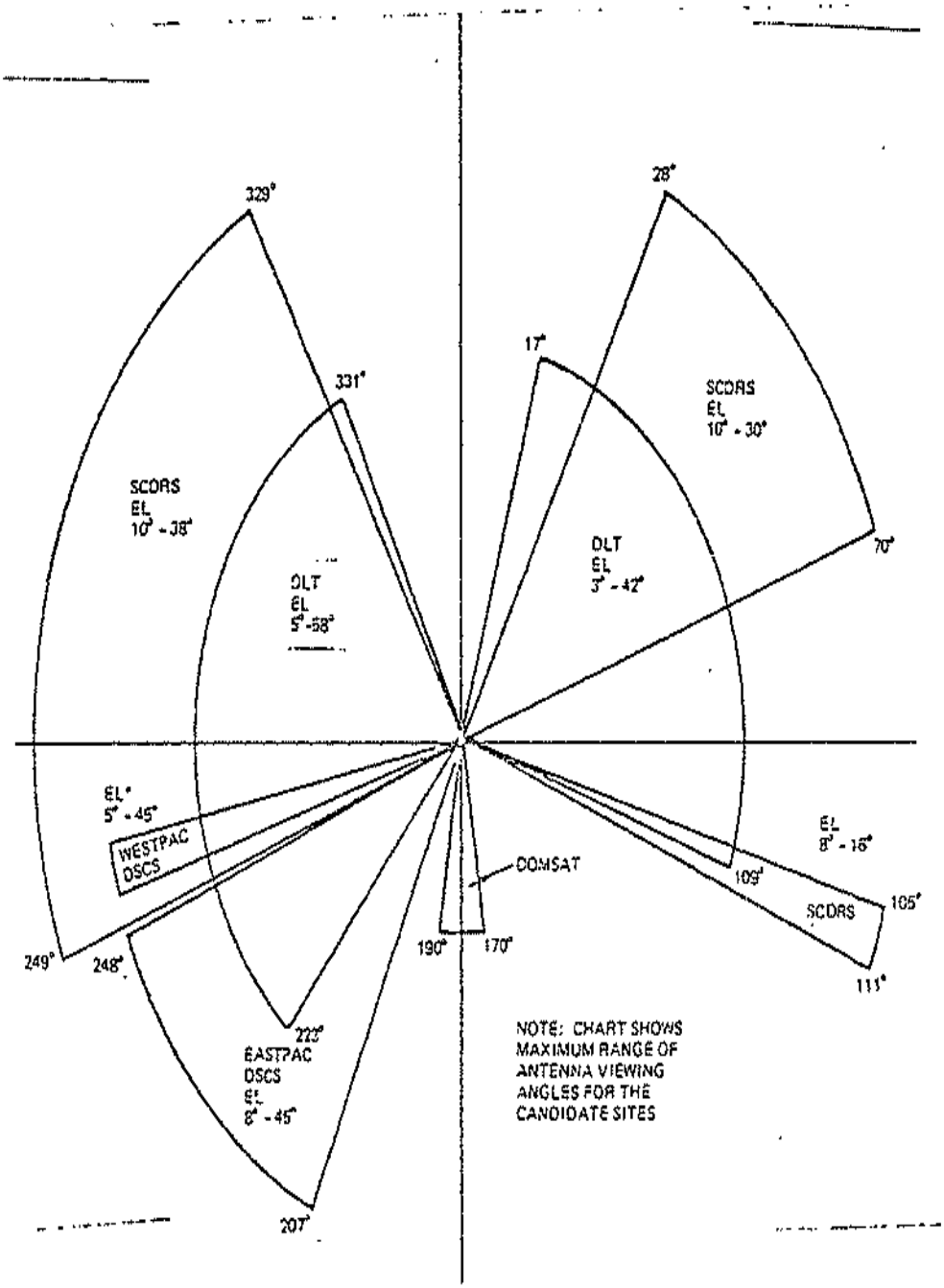
Table 2-3 EED Hazard Data

ANTENNA SYSTEM	POWER DENSITY (MW/Cm^2)			MAXIMUM RANGE OF HAZARD ZONE*** FROM ANTENNA (FT)
	EED THRESHOLD (FREQUENCY DEPENDENT)	ANTENNA RADIATION		
		NORMAL POWER	PEAK POWER	
SCDRS	2.65 *	2.43	14.51	16,768
SCDRS	10.00 **	2.43	14.51	7,600
DSCS	2.65 *	0.128	5.39	11,647
DLT	1.36 *	0.618	2.48	2,190
DOMSAT	2.65 *	0.166	0.25	N/A

*FOR AIRCRAFT IN LANDING CONFIGURATION

**FOR AIRCRAFT IN FLIGHT CONFIGURATION; INTERNAL/EXTERNAL EED'S

***HAZARD ZONE IS DEFINED AS AREA WITHIN WHICH SPECIFIED THRESHOLD IS EXCEEDED



*ASSUMES A MOVE OF WESTPAC
OF UP TO 10°

Figure 2-6 Antenna-Azimuth/Elevation Angle

2.2.1.2.1 The significance of the EED hazard to aircraft operations at candidate STC II sites is a function of the location of the antenna field relative to the runway(s) and traffic patterns. Accordingly, the potential impact at each site is addressed base-by-base in paragraph 2.2.4.

2.2.2 General Physical and Biological Factors. Water resources are adequate to supply the projected needs of all sites under consideration, with the exception of Sites 1B and 2 at Luke AFB and Site 1A at Cheyenne Mountain. At Luke, no water supply is currently available and wells or other sources would have to be developed. At the top of Cheyenne Mountain where the antenna field would be located, water would have to be pumped to the site from the main water line supplying the interior mountain facilities. At other sites, water is obtained from on-base wells or other local sources and is of fair to good quality. Storm drainage is adequate at all sites with the exception of Site 1 at Luke AFB and Nellis AFB, which were discussed earlier. The site at Offutt AFB is located within the 100-year floodplain of the Missouri River and will require flood protection measures to be incorporated into the design of the facility.

2.2.2.1 With the possible exception of a few native grasses and local vegetation, no significant impact will occur to biological (flora and fauna) resources at any of the sites. However, at Duluth and Hancock Field it will be necessary to remove dense stands of native trees. No endangered species of vegetation or wildlife have been identified for the specific sites under consideration.

2.2.2.2 No unique geologic or landform characteristics were identified at any sites which could be impacted by construction or operation of the proposed facility, with the possible exceptions of Site 1 at Luke AFB and Site 1A at Cheyenne Mountain. A salt dome underlies Luke AFB in the area where Site 1 is located. The potential impact of this formation was discussed in paragraph 2.1.3.1.1. At Site 1A, Cheyenne Mountain, the antennas would be constructed on the top of the mountain which is part of the geological landform comprising a highly significant ridgeline visible from other mountains nearby and from Pikes Peak Valley to the south and east. The presence of the antennas on the ridgeline and the grading scars resulting from construction of the access road connecting the antenna field with the remainder of the facility located inside the mountain could represent adverse aesthetic impacts on the present landform of Cheyenne Mountain.

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2.2.2.3 Air quality at each of the bases is somewhat variable but would not be adversely impacted by the construction or operation of the proposed facility. The facility will utilize commercial power on a normal operating basis; diesel-powered generators will be used for emergency and uninterruptible power requirements only. Air quality impacts resulting from the diesel generators are considered minor due to the infrequent and short duration of their operating periods.

2.2.2.4 Meteorological data for each base has been evaluated; with the exception of Offutt, Duluth and Hancock Field, there are no unusual impacts on personnel or facilities. The above three sites are located in areas subject to tornadoes, and as such are exposed to potential property damage, personnel injury and loss of lives resulting from severe storms. Careful consideration was given to the operational impact on satellite communications as discussed in paragraph 2.1.5.

2.2.2.5 The noise environment at each of the sites is primarily determined by aircraft operations and would not be adversely impacted by the proposed facility with the exception of short-term noise generated by construction activity. Noise is the principal source of complaint by the surrounding communities at each base and the Survey Team found AICUZ (Air Installation Compatibility Use Zone) data available and currently in use for community planning and development.

2.2.2.6 Although no archaeological, paleontological or historical sites have been identified to date on any of the proposed sites, surveys will be required to ascertain the presence of these cultural resources at the specific facility location ultimately selected. Because of the location of the sites on existing bases which currently utilize similar facilities and perform related activities, the visual and aesthetic impacts of the proposed facility are minimal except possibly at Buckley and Peterson (where residential housing is immediately adjacent), Offutt (where private residential development on a bluff overlooks the site), and Hancock Field (where the facility and the antennas would be highly visible from the Base Commander's home located to the west of the site). At Cheyenne Mountain (Site 1A), the antennas and access road could visually detract from the scenic beauty of the mountain. The base commander's residence on Hancock Field is estimated to be approximately 170 years of age, and this would qualify it for consideration on the National Register of Historic Buildings. There are many archaeological and paleontological areas -- primarily resulting from Indian activity -- in the vicinity of Hancock Field.

2.2.2.7 Utility services were found to be adequate to support the proposed facility in the general locale of all sites. In cases where all or part of the facility would be located in remote or undeveloped areas, such as Luke AFB Sites 1B and 2, and the sites at Kirtland, Buckley, Duluth Site 2 and Site 1A at Cheyenne Mountain Complex utility services would have to be extended. Commercial Power will be added to the existing SAGE facility if Hancock Field is selected for the proposed project. It should be noted that all bases may be subject to future limitations on natural gas utilization; also, hydroelectric power generation may be adversely affected by water shortages.

(The energy shortage experienced nation-wide a few years ago and the recent drought in the western U.S. are indicative of possible future limitations and the present emphasis on controlled use of these natural resources.)

2.2.3 General Socioeconomic Factors. Although no contact was made with community leaders or organizations, discussions with base personnel indicated that the general interface between the community and the bases are good to excellent at all locations. The addition of the proposed facility would have no adverse impact on this relationship and, in general, would probably be viewed as beneficial because of its positive effect on stimulation of the local economy.

2.2.3.1 The following general comments on socioeconomic factors apply to all bases except for Mountain Home AFB, Idaho, where a small community and its remote location from a significant metropolitan area create a unique situation. The socioeconomic impact at Mountain Home is discussed in paragraph 2.2.4.4.

2.2.3.2 The addition of approximately 1,100 operating personnel and a total population increase of 5,000 persons will have little impact on the other bases and their surrounding metropolitan areas. Public services appear to be adequate and increasing with the generally expanding business climate at most of the locations considered. The bases provide a significant contribution to the local economies and an increase in this level would be beneficial. Housing is currently meeting the needs of general growth at most of the sites, with adequate rental and purchase units becoming available as the population increases. Housing at Duluth and Syracuse (where Hancock Field is located) appears to be marginal as a result of development inactivity in recent years, the existence of older homes with maintenance problems, and the presence of inclement weather which shortens the time period during which construction can take place. Educational facilities at all levels are considered good to excellent, particularly in the Phoenix, Las Vegas, Ogden, Albuquerque, Denver, Colorado Springs, Omaha, Duluth and Syracuse areas.

2.2.3.3 Health services at bases and in nearby communities are adequate. Public transportation is available at Offutt, Duluth and Hancock Field, but only marginal service is provided to and from the base in each case. However, the prevalence of private automobile use and the quality of local roads and highways serve to mitigate the lack of adequate public transportation at all of the bases considered. Recreational and cultural facilities are excellent with the exception of Great Falls where cultural facilities are somewhat limited. Additional personnel would not place an undue burden on existing or developing facilities either on base or within the surrounding communities except at Buckley (which has limited on base support capabilities) and Hancock Field (where existing support facilities on base would be overtaxed with the twofold increase in base population generated by the proposed project). Viewed from the standpoint of incoming technical personnel with their families, all areas would offer attractive opportunities varying in nature with specific local conditions at the various sites.

2.2.4 Site Considerations. The following sections summarize specific environmental factors which should be considered at each base. The bases are listed in the order visited by the Survey Team.

2.2.4.1 Luke Air Force Base, Arizona

2.2.4.1.2 Physical and Biological Factors. At Site 1A, normal operation of the antennas present no theoretical EMR hazard to either personnel or EEDs. The nearest uncontrolled public access is Litchfield Road, which is 520 feet to the west. The vertical clearance between the road and the beam centerline is 92 feet. The nearest taxiing aircraft are 2400 feet from the antennas and at this distance the beam centerline is 233 feet above the runway. The hospital is located approximately 1500 feet to the south in a sector where none of the higher power antennas radiate. At peak power, EED hazard levels are exceeded for aircraft in the landing and gear-up configurations in the area above the northeast end of the runway. The hazard zone for aircraft in landing configuration extends to a slant range of 16,768 feet and for gear-up configuration to a slant range of 7,600 feet from the antennas.

2.2.4.1.2.1 Access control must be maintained within the fenced area and field measurements must be made after antenna installation to evaluate hazard zones resulting from reflection (off nearby structures). Air traffic must be restricted during peak power operation of the antennas.

2.2.4.1.2.2 At Sites 1B and 2, the antennas at Auxiliary Field No. 1 present no theoretical hazard to either personnel or EEDs at normal operating power levels. The worst case is in the west/southwest direction where three antennas could be radiating simultaneously. These antennas operate at non-overlapping elevation angles; however, hazardous power densities exist for EEDs on aircraft in the takeoff, landing and gear-up configuration when peak power is employed. For ground level exposed EEDs, the beam centerline is 197 feet above the ground at the nearest fence boundary at the north and no hazardous levels will exist. Access control must be maintained within the base and particularly within the fenced antenna area. Aircraft training activity would be restricted when the antennas are operated at peak power.

2.2.4.1.2.3 If Site 1B were selected, a microwave system might be employed to provide communications between the remote antenna field at Aux. 1 and the STC II facility at Luke AFB. The necessary microwave towers/terminals would be located on the antenna field at Aux. 1 and in the northwest corner of the main base, respectively. (Underground cables would connect the on-base terminals with the STC II facility at the current SAGE area.) Direct line-of-sight exists between Aux. 1 and the main base, and the microwave beam would be 50'-100' above the ground yet beneath all traffic patterns. Aircraft practicing instrument approaches to Aux. 1 do not land; they execute missed approaches and remain well above the microwave beam.

2.2.4.1.3 Socioeconomic Factors. The city of Phoenix lies approximately 20 miles east of Luke AFB and had a 1974 population of 725,000. There are approximately 7,700 employees at Luke AFB at the present time. The addition of 1,100 project personnel and a total of 5,000 additional population should result in a beneficial impact to both the base and the surrounding

communities. There is no shortage of developable land in the vicinity of Luke AFB, and water availability from the Central Arizona Project and other sources is capable of supporting a tripling of the area's population by the year 2000.

2.2.4.2 Nellis Air Force Base, Nevada.

2.2.4.2.1 Physical and Biological Factors. The proposed site at Nellis AFB presents no EMR hazard to personnel, aircraft in flight, or exposed EEDs under normal operating power levels. The ordnance hauling road is located 3000 feet to the north and at its nearest point the beam centerline of the antenna is 215 feet above the road. The antenna in this case has relatively low maximum power and is well below the maximum permissible power density level at the beam centerline. The beam centerline for a second antenna is more than 500 feet above the road. The ordnance storage area is 9000 feet to the east and has a 1500 foot clearance to the beam centerline. Taxiing aircraft are no closer than 9000 feet to the west and the antenna beam is 1200 feet above the runway at this point. The nearest public access is 260 feet to the south and the beam centerline is 232 feet above the fence at this point. When peak power is used, several antennas produce hazardous power densities for EED's on aircraft in the takeoff or landing configuration out to a slant range of 16,768 feet from the antennas. Hazard zones for aircraft in the gear-up configuration are produced out to a slant range of 7600 feet from the antennas. For these reasons it will be necessary to restrict air traffic when the antennas are operated at peak power.

2.2.4.2.2 Socioeconomic Factors. The Las Vegas metropolitan area is approximately 10 miles to the south of Nellis AFB and has a population of 275,000. Nellis on-base employment is currently at 9600 and the addition of 1100 project personnel is not expected to have an adverse impact. The addition of 5000 total population will not have a significant impact on the metropolitan area.

2.2.4.3 Hill Air Force Base, Utah.

2.2.4.3.1 Physical and Biological Factors. The potential site at Hill AFB presents no EMR hazard to personnel, EEDs, or aircraft in flight under normal operating power. The ordnance storage and handling area is located 2400 feet to the east and approximately 105 feet above the antenna location. Theoretical analysis indicates a 345-foot vertical clearance between ground level and the beam centerline. The runway is located 9600 feet to the east on a plateau 210 feet above the antenna. At this point a 657-foot vertical separation exists between taxiing aircraft and the beam centerline. The nearest uncontrolled public access is 1200 feet west and 50 feet below the antenna site. This area includes the railroad and Interstate Highway 15; the exposed EED zone is over 240 feet above passing traffic. It should be noted that the land across I-15 is being publicly developed and that future high-rise buildings could encounter hazardous EMR if built above a 250-foot height adjacent to I-15. Power density levels which would be hazardous for EEDs on aircraft in the takeoff or landing configuration will be produced at peak power operation out to a slant range of 16,768 feet from the antennas. A hazard zone for aircraft in a gear-up configuration will exist within a slant range of 7600 feet from the antennas. The hazardous zones are above the

northwest portion of the runway, in the northeast approach zone and along the west side of the runway. For these reasons it will be necessary to restrict air traffic when the antennas are operated at peak power.

2.2.4.3.2 Socioeconomic Factors. The Hill AFB area is in Weber County which has a population of 137,000. The base population is 18,673 and the addition of 1100 project personnel would have an insignificant impact. The addition of 5000 total population to Weber County and other surrounding areas would have a beneficial impact as a result of stimulating the local economy.

2.2.4.4 Mountain Home Air Force Base, Idaho.

2.2.4.4.1 Physical and Biological Factors. The potential location at Mountain Home AFB presents no EMR hazard to personnel, aircraft in flight, or EEDs under normal operating power. The base housing 2000 feet to the south has a vertical clearance of 300 feet to the beam centerline. At the base main gate 3400 feet to the northwest, the beam centerline is 640 feet above ground level. Public access to off-base areas may occur at the fence lines to the north and east at a distance of 1500 feet from the antennas. At the fence there is a 270-foot vertical separation between ground level and the beam centerline. The nearest ordnance storage and handling area is 6800 feet to the west and the clearance between ground level and the beam centerline is over 1000 feet. Taxiing aircraft on the runway 12,000 feet to the southwest will experience no EED hazards under normal power operation; however, at peak power an EED hazard zone will exist above the northeast and middle portions of the runway out to a slant range of 16,768 feet for aircraft in a landing configuration. A hazard zone for aircraft in gear-up configuration exists within a slant range of 7600 feet to the antennas. For these reasons it will be necessary to restrict air traffic when antennas are operated at peak power.

2.2.4.4.2 Socioeconomic Factors. The city of Mountain Home (also the seat of Elmore County) is 10 miles northeast of the base along U.S. Interstate 80N. With a population of 7000, it is heavily dependent upon the base and surrounding agricultural ranching businesses. The town has grown by about 100 persons per year, while the county growth in the general area has been about 200 to 300 persons per year. Approximately 1600 base employees live off base. In 1970 there were 4800 occupied civilian housing units; almost 250 of them lacked all or some plumbing. The 4800 units consisted of 2200 owner-occupied and 2600 rental units. It is apparent that the addition of 5000 persons to the community would have a significant impact on public services, housing, education, and health services. While the stimulus to economic growth would be great, the ability to accommodate this influx of population within a reasonable period of time is questionable. The nearest community able to provide cultural activities and other socially-oriented services of any magnitude is the city of Boise located 56 miles to the northwest. Recreational and cultural services are notably absent in the Mountain Home area and travel time to Boise is considered generally undesirable.

2.2.4.5 Malmstrom Air Force Base, Montana.

2.2.4.5.1 Physical and Biological Factors. The potential antenna site at Malmstrom AFB presents no EMR hazard to personnel, aircraft in flight, or exposed EED's under normal operating power. The limited access road adjacent to the antenna field is 400 feet to the southeast and the beam centerline is approximately 75 feet above the road in this area. Although this may be adequate clearance, field measurements should be made after antenna installation to confirm theoretical calculations. Highway 87/89 lies 1600 feet to the south and 300 feet below the beam centerline. Taxiing aircraft at the nearest point on the runway are 3800 feet distant and 800 feet below the beam centerline, and no EED hazard exists at ground level. However, at peak power, EED hazard zones will exist above the southwest portion of the runway and in the southwest approach area. These EED hazard zones extend to a slant range of 16,768 feet for aircraft in a landing configuration and to 7600 feet for aircraft in a gear-up configuration carrying internal or external EEDs. These factors will require restriction on air traffic when the antennas are operated at peak power.

2.2.4.5.2 Socioeconomic Factors. The Great Falls urban area had a population of 77,000 in 1976 and the addition of 5000 persons would have a significant, though generally beneficial impact. Malmstrom AFB employs over 9300 persons and could easily accommodate the additional 1100 project personnel, particularly when other mission changes involving reduced employment at Malmstrom are considered.

2.2.4.6 Kirtland Air Force Base, New Mexico.

2.2.4.6.1 Physical and Biological Factors. At the proposed site, normal operation of the antennas present no theoretical EMR hazad to either personnel or ground level EEDs. The nearest public access is the southern boundary of the base located 3000 feet from the nearest antenna. In this sector, extremely low power antennas create no hazardous radiation. Lovelace Road to the west is 2600 feet from the antennas and at an elevation 80 feet lower. Although several antennas radiate in this direction, in the worst case the lowest beam centerline is 350 feet above the road and the 0.1 mw/cm^2 power density level is 320 feet above the road. All other active areas are at greater distances from the antennas. For example, the Manzano Area (containing storage bunkers) is 13,200 feet north of the antennas and the east end of the main runway is 40,400 feet distant. At peak power, EED hazard levels for aircraft in a landing configuration extend 16,768 feet from the antennas in specific sectors; however, none of these zones are closer than 4.5 miles to the main runway. EED hazard zones for aircraft in a gear-up configuration extend 7600 feet from the antennas but none of these zones are closer than 6.2 miles to the main runway.

2.2.4.6.2 Socioeconomic Factors. The city of Albuquerque is a well-developed center of population with a strong economy and a high level of services; the addition of 5000 persons to the existing regional population of 400,000 would have an insignificant effect on local employment, existing services and facilities, educational institutions, housing supply, and other socioeconomic factors. An on-base hospital with adequate beds is available. However, due

to a shortage of military medical doctors, this facility is limited in its capacity to satisfy the current needs of Kirtland residents. The project population will undoubtedly utilize civilian medical facilities in view of this limitation.

2.2.4.7 Buckley Air National Guard, Colorado.

2.2.4.7.1 Physical and Biological Factors. At the proposed site, normal opeation of the antennas will present no theoretical EMR hazard tc either personnel or ground level EEDs. At peak power, however, a residential-zoned area immediately to the west of the base boundary may be subjected to power densities in excess of 0.1 mw/cm^2. The lowest calculated 0.1 mw/cm^2 contour has been determined to be approximately 100 feet above level ground. The roof lines of future homes, particularly if built on higher ground, would reduce this clearance significantly. In addition, as many as three antennas could be directed in the same general direction and their radiation levels would be compounded. The nearest point of possible public access is the federally-owned game refuge land. This land is within 200 feet of the nearest antenna and at this point the 0.1 mw/cm^2 contour is approximately 40 feet above ground level. The two antennas located across the runway to the northeast are 1000 feet from the base boundary adjacent to the privately-owned land, and do not present a hazard to personnel. An EED hazard zone extends over the southern end of the runway when the antennas are operated at peak power. This creates a hazard for aircraft in a landing configuration. In addition, EED hazard zones extend out to 16,768 feet slant range from the antennas for aircraft in a landing configuration and out to 7600 feet slant range for gear-up configured aircraft with internal and external EEDs. These factors will result in restricted air traffic during peak power operation.

2.2.4.7.2 Socioeconomic Factors. Buckley ANG is supported by the metropolitan area of Denver and the nearby city of Aurora. Aurora with a current population of 140,000 (January 1978) is reputedly the fastest-growing city in its population category. Therefore, new and ongoing residential development is very active and it appears that a wide variety of housing stock will be available for the foreseeable future. On-base services are limited primarily to fire protection and a 24-hour/7-day per week medical dispensary manned by paramedics. The project population will substantially increase the base population of 2000 with attendant overloading of the already limited on-base support facilities and services. The nearby local community of Aurora has adequate facilities and services to accommodate the project population and the larger metropolitan area of Denver offers a wide variety of cultural, educational and recreational opportunities.

2.2.4.8 Peterson Air Force Base, Colorado.

2.2.4.8.1 Physical and Biological Factors. At the proposed site, normal operation of the antennas presents no theoretical EMR hazard to either personnel or ground level EEDs. The nearest public access is the northern base boundary located approximately 200 feet from the closest antenna.

This area is planned for industrial and residential use and includes several knolls at higher elevations. An existing residence is located 1600 feet northeast of the site on a point 60 feet above the antenna site. At this point the beam centerline is 80 feet from the roof line to the 0.1 mw/cm^2 contour. No hazardous levels are generated along the main base access road to the west or in the base housing area to the south. EED hazard zones applicable to aircraft in a landing configuration exist in several sectors when antennas are operated at peak power. These sectors extend outward from the antennas 16,768 feet and include areas above the main runway and the northern approach. EED hazard zones applicable to aircraft in a gear-up configuration with internal and external EEDs will exist in certain sectors within a 7600 foot slant range of the antennas. These sectors also include areas above the main runway and the northern approach. It will be necessary to restrict certain air traffic during peak power operation.

2.2.4.8.2 Socioeconomic Factors. The city of Colorado Springs is a well-developed center of population with a strong economy and more than adequate services and facilities to accommodate the addition of 5000 persons to the area. Historical trends indicate that Colorado Springs and the nearby communities (known as the Pikes Peak Regional Area) will continue to grow at an average rate of 3%-5% over the next few years. Housing stock in the Peterson area appears to be ample with selling prices in the average price range of $40,000 to $50,000. The level of support services and facilities at Peterson AFB, combined with those provided by the nearby city of Colorado Springs, creates a very favorable living environment for residents and military and civilian employees at Peterson AFB. Although the added project employees will increase the current work force at Peterson by 50%, it is not expected to generate any problems with respect to on-base support services and facilities. The planned enlargement of the adjacent municipal airport will undoubtedly add to existing traffic in the area, and will probably attract additional commercial and industrial development in the areas adjoining Peterson AFB. This development will bring about increased traffic congestion. The addition of 1100 employees at Peterson will also generate on-base traffic congestion, particularly during morning and evening peak traffic hours at the main gate.

2.2.4.9 Cheyenne Mountain Complex, Colorado.

2.2.4.9.1 Physical and Biological Factors. At Site 1A, normal power operation of the antennas presents no theoretical EMR hazard to either personnel or aircraft. It is assumed that public access will be restricted in the area around and below the antenna field. The peak of Cheyenne Mountain is located 5000 feet to the west-southwest and is approximately 145 feet higher than the antennas. At peak power this mountain top is approximately 490 feet below the 0.1 mw/cm^2 contour. No personnel hazard will exist at peak power operation although EED hazard areas will exist in certain sectors. The EED hazard zone will extend to a slant range of 16,768 feet for aircraft in a landing configuration, and to 7600 feet for aircraft in a gear-up configuration with internal or external EEDs. The antenna field is over nine miles from Peterson AFB runways and the EED hazard zone is over six miles distant. There will be no adverse impact on flight activity at the base; however, flight in the EED hazard zones must be restricted when antennas are operated at peak power.

2.2.4.9.1.1 Site 1B locates the antenna field at Peterson AFB where normal operation of the antennas presents no theoretical EMR hazard to either personnel or ground level EEDs. The nearest public access is the northern base boundary located approximately 200 feet from the closest antenna. This area is planned for industrial and residential use and includes several knolls at higher elevations. An existing residence is located 1600 feet northeast of the site on a point 600 feet above the antenna site. At this point the mean centerline is 80 feet above ground level and at peak power operation there will be a clearance of 30 feet from the roof line to the 0.1 mw/cm^2 contour. No hazaradous levels are generated along the main base access road to the west or in the base housing area to the south. EED hazard zones applicable to aircraft in a landing configuration exist in several sectors when antennas are operated at peak power. These sectors extend outward from the antennas 16,768 feet and include areas above the main runway and the northern approach. EED hazard zones applicable to aircraft in a gear-up configuration will exist in certain sectors within 7600 feet slant range of the antennas. These sectors also include areas above the main runway and northern approach. It will be necessary to restrict certain air traffic during peak power operations.

2.2.4.9.2 Socioeconomic Factors. The Cheyenne Mountain Complex relies heavily on Peterson AFB (18 miles distant) and on the Air Force Academy and Fort Carson, for several base support services (procurement, recreation and welfare, medical and dental, etc). The addition of 1100 project personnel is not expected to generate any problem with respect to these services. The peak shift, however, consists of 900 employees, adding to traffic congestion on the single access road leading from the main highway (Route 115) to the mountain. Since all employees are transported by bus from the outside parking lot to the interior buildings, either additional buses or staggered shifts, or both, may be needed to handle the additional work force. The City of Colorado Springs is 12 miles north of the mountain; it is a well-developed center of population with more than adequate services and facilities to accommodate the project population of 5,000 persons. Housing stock in the Colorado Springs area appears to be adequate, with selling prices in the average range of $40,000 to $50,000. The recreational, social, cultural and educational facilities offered in the Pikes Peak area (including Colorado Springs and vicinity) are such that a very favorable living environment is available to residents of the area.

2.2.4.10 Offutt Air Force Base, Nebraska.

2.2.4.10.1 Physical and Biological Factors. Normal power operation of the antennas will present no theoretical EMR hazard at ground level to personnel or EEDs outside the fenced antenna area. The nearest point of public access is one the road which bounds the antenna field to the north. This road is approximately 400 feet from the antennas and at peak power, the 0.1 mW/cm^2 contour is 44 feet above grade. Actual field measurements should be made after antenna installation to assure safety. Residential areas in the City of Bellevue are situated approximately 3700 feet north of the antennas on a bluff which is 80 fest above the antenna site. In this area, the 0.1 mw/cm^2 contour is no closer than 260 feet to the ground in the worst case. The County road to the east is 800 feet from the antennas and the Lake Offutt recreational area is slightly beyond the road to the east. A clearance of 67 feet exists between the road surface and the 0.1 mW/cm^2 contour at peak power operation.

2.2.4.10.1.1 At peak power, EED hazard zones will be created above the main runway and in other sectors around the antenna field. These hazard zones will extend to a slant range of 16,768 feet for aircraft in a landing configuration and to 7600 feet for the gear-up configuration with internal or external EEDs. For example, two hazard zones will exist above the main runway centerline along the southeastern end of the runway. One zone, 380 feet above the runway will have a power density of 14.5 mW/cm^2 which exceeds the limit for aircraft in both the landing and gear-up configurations. Another hazard zone, 1175 feet above the runway will have a power density of 4.2 mW/cm^2 which exceeds the limit for aircraft in a landing configuration. These zones will require restriction of flight activity when certain antennas are operated at peak power.

2.2.4.10.2 Socioeconomic Factors. The City of Omaha with a population of about 360,000 is part of a larger regional area that includes Council Bluffs (in Iowa), Bellevue, Papillion, and other communities, for a total regional population of around 575,000. The regional area has a stable and growing economy. New housing developments are being constructed in the Omaha area and in the vicinity of the base. Housing prices range from $40,000 to $70,000. Offutt AFB is a fairly large installation employing almost 15,000 military and civilian personnel. It has ample support facilities and services to accommodate the proposed project personnel and facility requirements. Educational, cultural and recreational opportunities are adequate in the Omaha area. Mention was made, however, by base personnel that the project's need for highly skilled professional employees would probably require drawing upon other areas (such as Lincoln 60 miles away) due to the lack of technically-skilled residents in the Omaha area.

2.2.4.11 Duluth International Airport, Minnesota.

2.2.4.11.1 Physical and Biological Factors. Normal power operation of the antennas will present no theoretical EMR hazard at ground level to personnel or EEDs outside the fenced antenna area. The nearest points of public access are the base boundaries to the west, north, and east. At the northern boundary, 2000 feet from the antennas, the 0.1 mW/cm^2 contour will be no closer than 132 feet to the ground at peak power. The base area surrounding the antenna area is sufficiently large to provide the 1000-foot buffer zone and is unlikely to be developed due to the swamps in much of the area.

2.2.4.11.1.1 At peak power, several EED hazard zones will be produced above and around the runways. These hazard zones will extend to a slant range of 16,768 feet for aircraft in a landing configuration, and to 7600 feet for the gear-up configuration with internal or external EEDs. For example, an area hazardous to both aircraft configurations will exist 340 feet above the northeast end of the NE/SW runway at a power density of 14.5 mW/cm^2. Two areas hazardous to aircraft in a landing configuration will exist over the main runway. At the west end, the hazard zone is 1490 feet above the runway centerline at 6.2 mW/cm^2 and at the midpoint of the runway, the hazard zone is 1296 feet above the centerline at 5.25 mW/cm^2. For these reasons, it will be necessary to restrict aircraft activity when antennas are operated at peak power.

2.2.4.11.2 Socioeconomic Factor. The city of Duluth is 7 miles southeast of Duluth IAP; it has a population of about 100,000. Duluth has more than adequate cultural, recreational and educational opportunities to offer the project population. It is marginal, however, in terms of the capacity of the secondary public school system. Good quality housing is in short supply (both rental and sales) at Duluth due to the fact that there has been little demand for new housing in the past and there is a relatively short construction period due to the severe winters. The added employment opportunities generated by the proposed project will benefit the local economy by tending to smooth out the seasonal employment cycle that results from a heavy reliance on the shipping industry. The extreme cold climate with frequent below-zero temperatures accompanied by chilling winds, requires purchase and upkeep of warm winter clothing, and added expenses in maintaining comfortable interior temperatures in homes. These factors generate a cost of living beyond that incurred in less severe climates.

2.2.4.12 Hancock Field, New York.

2.2.4.12.1 Physical and Biological Factors. Normal power operation of the antennas will present no theoretical EMR hazard at ground level to personnel or EEDs outside the fenced antenna areas. At peak power, the antenna field location in close proximity to base facilities and roads will result in marginal clearance distances between points of habitation and the 0.1 mW/cm^2 contour. Although these clearances are theoretically adequate, field measurements must be made after antenna installation to assure safety. Specific points of concern include base housing to the north which will have a 26-foot clearance between roof lines and the 0.1 mW/cm^2 contour, the northern antenna field fence with a 33-foot clearance, and the base road to the west with a 40-foot clearance. Other points of concern are the SAGE building roof (55-foot clearance) and Watertown Road (57-foot clearance). The nearest point of public access is to the south and no antennas are beamed in this direction. The Base Commander's home, although only 800 feet from the antennas, will have over 100 feet clearance from the roof line to the 0.1 mW/cm^2 contour. At peak power, several EED hazard zones will be produced above and around the runways. These hazard zones will extend to a slant range of 16,768 feet for aircraft in a landing configuration and to 7600 feet for the gear-up configuration with internal and external EEDs. For example, an area hazardous to both aircraft configurations will exist 517 feet above the centerline of the northwest/southeast runway at a power density of 14.5 mW/cm^2. Areas hazardous to aircraft in a landing configuration will exist 623 feet above the midpoint of this runway at a power density of 4.2 mW/cm^2. At the west end of the main east/west runway, two zones hazardous to aircraft in the landing configuration will exist at 1517 feet and 2073 feet above the runway. For these reasons, it will be necessary to restrict aircraft activity when the antennas are operated at peak power.

2.2.4.12.2 Socioeconomic Factors. Hancock field is 6 miles north of the City of Syracuse, which is the urban center for this part of New York State. Due to the abundance of rivers and lakes, outdoor recreational opportunities are good, particularly in spring, summer, and fall months. Higher educational facilities abound in Syracuse; the public school districts supporting Hancock Field, however, are in a period of declining enrollment and have subsequently

reduced their staff and the number of classrooms. The project will generate a need to expand the staff and reopen classrooms in order to accommodate incoming school-age children. New housing supply is marginal as a result of a slowdown in development over the past few years caused by a State-imposed limitation on bank loan interest rates and a natural gas moratorium. Both of these limitations have recently been relaxed and it is anticipated that development will increase. Support services and facilities on-base will probably be inadequate to serve the project employees since Hancock Field is a very small installation with only about 1300 employees. The proposed project will nearly double the working population on the base. Recreational, cultural, medical and other support facilities and services are more than adequate, however, due to the nearby City of Syracuse.

2.3 Base Support Capability. Base support capabilities, as used in this report, refer to the support functions that are available from the host base via a host-tenant agreement in accordance with AFR 11-4. (Excluded, because of the ground rules of the survey, are those support capabilities available from the civilian community.) In the case of Duluth IAP and Hancock Field, however, it has been deemed appropriate to assume that the AFSCF would be the host, because STC II would represent the largest organization on the base. Note that Duluth and Hancock are by far the smallest "self-contained" bases of the twelve surveyed. (Buckley and Cheyenne Mountain, which are also very small, receive support from nearby large bases: Peterson and Lowry, respectively.)

2.3.1 Personnel Support. Those on-base functions required to support a military population are summarized in this section.

2.3.1.1 Base Population Characteristics. Approximate base population categorized by types of employees, retirees, and dependents is presented in Table 2-4 for each of the surveyed bases. The Peterson AFB values include support personnel for Cheyenne Mountain Complex and the Chidlaw Recreational Complex (in downtown Colorado Springs).

2.3.1.2 Housing. All bases, except Buckley ANGB and Cheyenne Mountain Complex, have some combination of on-base housing divided into four categories: (1) family quarters, (2) bachelor quarters, (3) visiting personnel quarters, and (4) guest quarters. Lowry AFB, located approximately six miles west of Buckley, could provide some housing support for military personnel stationed at Buckley, if properly coordinated in a host-tenant agreement. Peterson AFB presently provides housing support for the Cheyenne Mountain Complex. Availability of base housing for all the proposed sites is summarized in Table 2-5. None of the bases has adequate housing for all assigned military, therefore, a large segment depends upon obtaining housing in the local communities. Each base has a shortage of housing in certain categories; in particular, bachelor quarters are in very short supply at each base except Kirtland AFB. Although all available officer bachelor units are presently filled at Kirtland, the enlisted dormitories are only 57% full. Most available rooms are occupied, but a surplus of rooms has allowed local officials to approve single-person occupancy of space normally assigned to two airmen. An influx of several hundred additional bachelor personnel would be absorbed by either filling these rooms to their rated capacity of two people or possibly renovating three presently empty dormitories in the Manzano complex.

Table 2-4 Base Population by Category (Approximate)

Base	Military Service	Civil	Contractors & NAF Civilians	Military Dependents On-Base	Dependents Off-Base	Retirees
Luke	6303	1156	963	3940	7880	13265
Nellis	8054	1103	394	4200	10100	7000
Hill	4400	14084	496	3056	5175	2500
Mtn Home	4600	472	456	3032	1822	300
Malmstrom	5120	673	1575	3860	3180	Not Available
Kirtland	4080[a]	2083[c]	7676	4579	3303	10268
Buckley	707[b]	728	511	None	None	Not Available
Peterson	4605	1562	448[d]	1323	9180	10500
Cheyenne Mt	1122	152	275	None	None	Not Applicable
Offutt	12439	1701	1766	10756	13296	4673
Duluth	1122	262	210	1050	575	1200
Hancock	928	351	113	662	1012	400

NOTES:

a. Does not include approximately 900 New Mexico ANG personnel or 609 military personnel assigned off-base.

b. Includes 8 National Guard advisors and 44 EAD reservists. Does not include 1936 assigned reservists.

c. Does not include 119 DOD civilian assigned off-base.

d. Includes only long-term contractors.

Table 2-5 Housing Summary

BASE	FAMILY QUARTERS		BACHELORS OFFICERS QUARTERS		BACHELORS ENLISTED QUARTERS		VISITING OFFICERS QUARTERS		VISITING AIRMEN QUARTERS		CHEST QUARTERS
	Number of Units	Occupancy Rate %	Number of Units	Occupancy Rate %	Number of Units	Occupancy Rate %	Number of Units	Occupancy Rate %	Number of Units	Occupancy Rate %	Number of Units
LUKE	875	99.1	44	100	1389	97	119	97	50	85	40
NELLIS	1497[a]	98	None	-	2168	100	184[b]	100 during Red Flag	282[b]	82	20
HILL	1145	100	None	-	740	97	129[b]	85	75	80	0
MTN HOME	1538	99	30	100	1706	91	18	100	None	-	36
MALMSTROM	1536[c]	98	76	95	1666	95	29	65	16	65	None
KIRTLAND	2134	97	46	>96	2109[d]	57[e]	211	71	169	33	42
BUCKLEY[f]	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None
LOWRY	867	>99	None	N/A	670	85	335	78	680	68	40
PETERSON	490	99	40	98	804	>98	40[h]	>80[h]	59	>64	40
CHEYENNE MTN	None[i]	-	-	-	-	-	-	-	-	-	-
OFFUTT	2680	99.2	None	N/A	2144	95	86	85[h]	56	85[h]	4
DULUTH	454[gg]	99.7	23	100	692	68	12	70[h]	8	83[h]	4
HANCOCK	308[j]	99.1	None	N/A	274[k]	94[k]	None[h]	N/A	None[h]	N/A	2

a. Mobile Home Park also available.
b. Commercial motels are also used under contract.
c. Includes 130 inadequate trailers.
d. Includes 23 BNCOQ and 150 female dormitory spaces.
e. Local policy dictates one person per room occupancy, based upon bed spaces.
f. Buckley ANG Base has no available housing.
g. Includes 64 inadequate spaces and 45 leased units.
h. During peak periods occupancy rates are 100%. At such times overflows are provided quarters at civilian motels under contract.
i. Housing support is provided by Peterson AFB.
j. Includes 80 leased units.
k. Additional 126 units are secured. Occupancy rate based on 274 accountable units.

2.3.1.2.1 The family housing situation at Kirtland also deserves special comment. There are presently 25-30 officer units vacant and 382 NCO family units (of 2134 total units) are now occupied by lower grade airmen normally not authorized NCO quarters. A surplus of family units allowed this policy. Availability of private family housing in the surrounding communities is adequate to absorb the new facility's projected workforce for all locations except Mountain Home and possibly Duluth. For instance, the present building rate of private housing in the Albuquerque area is 500 units per year. Relying on private community housing in lieu of constructing additional military housing is consistent with government policy as outlined in AFR 90-1. Discussion of the housing problem at Mountain Home and Duluth is provided in paragraph 2.2.2.

2.3.1.3 Messing. Messing facilities are available at all bases. Breakfast, lunch, dinner, and snacks may be obtained from base military dining halls, Officer and NCO clubs (except Buckley ANGB), base exchange cafeterias (except Hill AFB, Cheyenne Mountain Complex and Buckley ANGB), and non-appropriated fund snack bars. The Lowry AFB Officers club serves lunch and dinner meals only. Buckley ANGB and Cheyenne Mountain Complex have single dining facilities operated by the military, however, all assigned military and civilian employees are authorized meals.

2.3.1.4 Health Services. Medical, dental and veterinarian services are at all bases. Hospitals exist at all bases except Peterson AFB, Buckley ANGB, Duluth IAP and Hancock Field, where medical clinics are provided. Cheyenne Mountain Complex has a fully equipped emergency operating room, but under normal conditions only a medical technician is assigned to handle minor injuries and illnesses. For more serious cases, patients are taken by ambulance to hospital/clinics at Fort Carson, Peterson AFB, the Air Force Academy or civilian facilities. None of the medical facilities are used for referrals, although Luke AFB, Nellis AFB, Mountain Home AFB, Kirtland AFB and Buckley ANGB are serviced by Military Airlift Command Aeromedical Evacuation flights (patients from Peterson can be ambulanced to Buckley, if necessary). The Peterson AFB Clinic is augmented by hospitals located at nearby US Army Fort Carson and the Air Force Academy. In addition, both Peterson and Buckley clinics are augmented by the Fitzsimmons Army Medical Center located in Denver. Buckley ANGB also has an agreement with the Aurora Presbyterian Hospital, located about three (3) miles from the main gate, to treat emergency medical cases. Duluth IAP and Hancock Field medical clinics are augmented by nearby civilian hospitals for treatment of serious cases. At Hill AFB, civilians are treated by an Occupational Health Service Clinic. Veterinarian services are augmented by weekend reservists at many of the bases throughout the year.

2.3.1.5 Morale, Welfare, and Recreation (MWR) Services. All bases except Buckley ANGB and Cheyenne Mountain Complex have active MWR facilities and activities on base for use of military and dependent personnel. FAMCAMPs are operated at Hill AFB and Malmstrom AFB. Active duty personnel assigned to Buckley ANGB utilize MWR facilities at Lowry

AFB. A base club, open to all personnel, is operated at Buckley; however, services do not include dining facilities. Cheyenne Mountain Complex military personnel utilize the excellent Peterson AFB facilities.

2.3.1.6 Resale Services. Resale Services exist at each base (including Lowry in support of Buckley ANGB and Peterson AFB in support of Cheyenne Mountain Complex) and consist of a commissary and a variety of base exchange facilities and services. In addition, Buckley has a Colorado National Guard sponsored trading post for resale of sundry items.

2.3.1.7 Education Services. Only Mountain Home AFB, Peterson AFB, and Offutt AFB have public schools located on base. Public schools are located adjacent to all other bases and/or dependent children are bussed to school by the local school district. All bases except Cheyenne Mountain Complex, operate a preschool for four to five year olds. On-base college level and graduate level courses are available at each base; however, technical degrees are not available at all bases.

- At Luke AFB, advanced education in the management and social science disciplines are available but none lead to a three or four year degree. No courses in the science and engineering disciplines are available on base. The nearest such programs are thirty-seven miles away.

- At Nellis AFB, bachelors and masters programs in business, management, and some social science disciplines are available on base.

- At Hill AFB, masters programs are available on base in the science and engineering, management, and social sciences disciplines.

- At Mountain Home AFB, masters and bachelors programs are available in the administration and management disciplines. A bachelors program in social science is also available. Thirty undergraduate courses not leading to a degree are also taught on base. About six science-related courses are taught at the city of Mountain Home, about ten miles from base, but the closest degree granting programs in the science and engineering disciplines are located in Boise, about fifty miles from base.

- At Malmstrom AFB, associate degree programs in six vocational technology disciplines are available. Bachelor degrees are available in twenty-four subjects in the business, management, science and social science disciplines. Masters programs are available in the business, management, and social science disciplines.

- Kirtland AFB has three (3) public schools located on base, which provide schooling from kindergarten through high school. No public schooling is available at Buckley ANG Base.

- In the Peterson AFB area, bachelors and advanced degree programs in technical and management areas, among others, are available on base, at Fort Carson, and off-base. The school district operates a Kindergarten on base. All other children are bussed off-base to public schools. Military personnel assigned to Cheyenne Mountain utilize Peterson AFB educational facilities. In addition community college courses are available on video cassette tapes.

- At both Kirtland AFB and Offutt AFB, bachelors and masters programs in business, management, sciences and social science disciplines are available on-base and off-base. Three elementary schools are located on each base. Children walk off-base or are bussed to Jr. High and High Schools.

- At Duluth, undergraduate programs in business, psychology and sociology and an MBA program are available on-base. Off-base schools provide graduate and undergraduate programs in education, art, sciences, social science, business, management, and health services. All dependent school children are bussed to downtown Duluth.

- At Hancock, on base programs include associate degree granting programs in the liberal arts and business management; bachelors programs in liberal arts, science and business management; and masters programs in business, humanities and psychology. Off-base schools provide undergraduate and graduate programs in education, business, sciences management, nursing, health services, computer sciences, engineering and communications. All school dependents are bussed off-base by the local school district.

2.3.2 Services. This section addresses those activities required to support the mission.

2.3.2.1 Administrative Services. In this report, administrative services refer to printing and reproduction services, distribution/publications and forms services and procurement and contracting support. Administrative services are available at all bases. Depending on requirements, the capability to provide these services may have manpower and equipment impacts.

2.3.2.2 Fire and Police Services. On-base fire and police services, including base security and the ability to provide personnel access control are summarized in this section. Both fire protection and security police forces are represented on the Disaster Preparedness Team.

2.3.2.2.1 Fire Protection. All bases except Cheyenne Mountain Complex have at least one fire station located on base. Luke AFB has one fire station located on the main base. If sites 1B, 1C or 2 are chosen (all involving part or all of the facility located off the main base), an additional fire station will be required. There are three fire stations located at Nellis AFB, one in Area II. One of the two stations at Hill AFB is located with a five minute response time to the proposed site in

the Northeast corner of the base. The one station at Malmstrom AFB can adequately respond to an emergency at either site but the only water at the southern site is via a two inch pipeline. Kirtland AFB has four fire stations positioned throughout the base. The Manzano station would respond to fire emergencies in the northern part of the base (locality of sites 1 and 2), with a backup provided by Fire Station No. 4. There are two fire stations at Buckley capable of responding to any fire emergencies. Peterson AFB has a combined structural/crash fire station that responds to fire emergencies at the locality of the proposed site. If Cheyenne Mountain Complex were chosen, additional firefighting capability would be required. The complex currently has only water hoses and fire extinguishers. No truck is available, though one is on order. Offutt has two fire stations, one structural and one crash. Under ideal conditions, the crash station can respond to the proposed site within 4 minutes. Duluth has a combined structural and crash fire station. The Duluth fire vehicles respond to Site 2 emergency in 3-5 minutes after notification if immediate runway clearance is obtained, otherwise within 15 to 20 minutes if required to go around the end of the runway. The single fire station at Hancock is within one minute of the proposed site.

2.3.2.2.2 Police Services. All bases have military security police force/squadrons except Buckley, which is served by a 20-man civilian police force. Hill AFB has a mixture of military and DOD civilian security police forces. Access to all bases is controlled by decals, security badges and/or identification cards through manned gates. All bases are considered closed bases, although only Nellis, Hill and Kirtland AFBs have perimeter patrols. Cheyenne Mountain Complex is a priority A facility, and priority A facilities exist at Luke AFB, Nellis AFB, Malmstrom AFB, Buckley ANGB, Offutt AFB, Duluth IAP and Hancock Field. The Security Police service a Priority C facility at Hill AFB. Personnel access control and perimeter patrols are provided at Buckley by military security forces furnished by tenant activities. The Peterson AFB police force at present has only law enforcement responsibilities throughout the base, and accordingly, the force would require augmentation by security specialists in order to support the proposed project. The area around the Cheyenne Mountain Complex entry is fenced and a two-man patrol is present at all times.

2.3.3 Logistics. Supply services and ground and air transportation support capabilities are summarized in this section.

2.3.3.1 Supply Services. All bases can provide for the purchase and distribution of administrative and office supplies, though each might require additional storage space if the supplies can't be housed in the new facility. No base has storage space for technical spares and supplies. It is considered desirable that supply services at Buckley ANGB be provided by Lowry AFB in order to avoid fiscal problems related to reimbursement of the Colorado Air National Guard for performance of such services. Cheyenne Mountain Complex relies upon Peterson AFB for supply support and Hancock Field upon Griffin AFB.

2.3.3.2 Transportation Services. All bases except Buckley ANGB and Cheyenne Mountain Complex have motor pools and can maintain the additional vehicles required for this project. Each base would require additional vehicle authorizations. If Buckley is selected, Lowry AFB could provide transportation services through host-tenant agreements. Cheyenne Mountain Complex relies upon Peterson AFB for transportation services. Each base, except Offutt and Hancock, is serviced daily by LOGAIR. Except for LOGAIR and the Aeromedical Evacuation flights, no other regularly scheduled flights service any base. All bases except Nellis AFB, Duluth IAP and Hancock Field can process passengers, but standby service is dependent upon number of transient flights. Hill AFB has extensive cargo handling capabilities; all other bases are limited. Kirtland AFB, Buckley ANGB and Peterson AFB have traffic management offices where airline ticket reservations can be made.

2.3.4 Communications. Each of the sites on the candidate bases were evaluated with regard to the following: (a) Commercial long-line interface capability; (b) Capability of local telephone company, either military or commercial, to support the requirements; and (c) Local base telecommunications services availability. The telephone exchange on each of the bases surveyed except Cheyenne Mountain, Duluth IAP, and Hancock Field is not expected to require expansion as long as a satellite exchange is installed within the new facility to support administrative requirements. The telephone exchanges for Cheyenne Mountain, Duluth IAP, and Hancock Field will be discussed later in this section. All sites surveyed except for Aux Field #1 located near Luke AFB had both AUTOVON and AUTOSEVOCOM services available. Except for Peterson AFB and Cheyenne Mountain, the AUTOVON and AUTOSEVOCOM services available are not sufficient to meet facility requirements. AUTODIN service required to support command and control requirements to remote tracking stations would have to be provided by either a new AUTODIN terminal or pony circuit from the host base telecommunications center at all sites surveyed except for Malmstrom AFB, Cheyenne Mountain, Duluth IAP, and Hancock Field. These sites either have AUTODIN terminals within the facility surveyed or have an approved program to relocate their telecommunications center into the facility surveyed.

2.3.4.1 Luke Air Force Base, Arizona. The sites at Luke AFB were evaluated separately.

2.3.4.1.1 Site 1A. This site has excellent diversity and interconnectivity into the commercial long-line system. No modifications or expansions to the present system are anticipated to meet the requirements. The telephone exchange and cable system for both the base and the SAGE facility are leased and maintained by the local telephone company. The local telephone company has the capability to support all communications requirements, but the exchange in the SAGE building is too small to meet requirements. Because the present exchange is leased equipment, it is expected to be removed when NORAD closes its operation and replaced by an exchange of sufficient size.

2.3.4.1.2 Sites 1B and 1C. These options involve locating the main control center facility, including the major communications hub, at Site 1A. The comments regarding Site 1A therefore largely apply. The antenna field, however, would be remoted to either Auxiliary Field No. 1 (Site 1B) or some closer-in but presently undefined location (Site 1C). Local voice communications between the main base and the remote antenna site would have to be established (if not already available). However, this should pose no serious problem.

2.3.4.1.3 Site 2. The capability for diversity and interconnectivity into the commercial long-line system exists in the area but is not presently available at the site. The present cable supporting the field would have to be expanded as well as an alternate route established to meet circuit diversity requirements. The same telephone company supporting Luke AFB would support the communications requirements at this site; therefore, no problems are anticipated in this respect. This site has no other telecommunications services.

2.3.4.2 Nellis Air Force Base, Nevada. Interfaces with the commercial long-line system exist, but the capability for circuit alternate routing/diversity is somewhat limited in the area and to the site. The cable system on base is owned by the local telephone company, and the exchange supporting the base is located off base in one of their commercial office exchanges. The cable supporting the proposed site would have to be expanded to support the new requirements. The Base Communications Officer indicated that in his opinion the local telephone company would have no problems in meeting our technical requirements; however, based on his own experience, delays could be anticipated in meeting short suspenses on major modifications. This is due in part to the demands placed on the telephone company in meeting the requirements of the local users downtown. This information could not be verified with the local telephone company.

2.3.4.3 Hill Air Force Base, Utah. This site has excellent diversity and interconnectivity into the commercial long-line system. The exchange and cable system on base is government-owned and maintained. Because of the major modifications often required to the command and control/tactical operational communications system, it felt that a leased system would better meet the facility's requirements. This concept has therefore been costed for O&M of this facility, versus a government-owned system with military maintainers.

2.3.4.4 Mountain Home Air Force Base, Idaho. This site has the poorest diversity and interconnectivity into the commercial long-line system. The only interface is located in Boise, Idaho, some 55 miles away, and only one microwave system exists between Mountain Home and Boise. The base exchange and cable system on base are leased and maintained by the local telephone company. It is anticipated that these requirements could have a major impact on the small telephone company in this area.

2.3.4.5 Malmstrom Air Force Base, Montana. This site has excellent diversity and interconnectivity into the commercial long-line system. The exchange and cable system on base and in the SAGE facility are leased and maintained by the local telephone company. As with the SAGE facility at Luke AFB, no expected modification or expansion to existing systems would be required except for replacement of the exchange in the SAGE facility. The local telephone company has the capability to support these requirements.

2.3.4.6 Kirtland Air Force Base, New Mexico. Interfaces with the commercial long-line systems at Kirtland AFB exist, but all circuits off-base would have to be routed to the Albuquerque main exchange. The base exchange and cable system on base is government owned and maintained. Like Hill AFB, it is felt that a leased system would better meet operational telephone requirements.

2.3.4.7 Buckley ANGB, Colorado. Buckley ANGB has excellent diversity and interconnectivity into the commercial long-lines system. The exchange and cable system on base are leased and maintained by the local commercial telephone company. Cable system to the proposed site location would have to be expanded.

2.3.4.8 Peterson AFB, Colorado. Peterson AFB has excellent diversity and interconnectivity into the commercial long-line system. The exchange and cable system on base are leased and maintained by the local commercial telephone company. No cable exists now into the proposed site location.

2.3.4.9 Cheyenne Mountain. Cheyenne Mountain has excellent diversity and interconnectivity into the commercial long-line system. The exchange and cable system on site are leased and maintained by the local commercial telephone company. The present exchange is large enough to meet the new facility requirements, if no other organization is collocated within the Mountain.

2.3.4.10 Offutt Air Force Base, Nebraska. Offutt AFB has excellent diversity and interconnectivity into the commercial long-line system. The exchange on base is leased from the local telephone company, but maintained by the military. The cable system is owned by the government. The cable system to the proposed site location would have to be expanded. Like Hill AFB and Kirtland AFB, a leased system would better meet operational telephone requirements.

2.3.4.11 Duluth International Airport, Minnesota. Duluth IAP has excellent diversity and interconnectivity into the commercial long-line system. The exchange and cable system on base are leased and maintained by the local telephone company. The base exchange is located within the SAGE facility and handles both the base and SAGE communications requirements. The exchange may require some expansion/replacement to meet both facility and base communications requirements. Local telephone personnel did not anticipate any problems in meeting the proposed facility requirements.

2.3.4.12 Hancock Field, New York. Hancock Field has excellent diversity and interconnectivity into the commercial long lines system. The exchange and cable system on base is leased and maintained by the local telephone company. Like Duluth IAP, the exchange is located within the SAGE facility and may require either expansion/replacement to meet both facility and base communications requirements. Local telephone personnel did not anticipate any problem in meeting requirements.

2.4 RESOURCE IMPLICATIONS. This section discusses resources implications of siting STC II or STC II/SOPC at the various bases. The following four areas are covered:

a. Construction Costs and Schedule Impact.

b. Operational Support (Utility Costs)

c. Communications Costs.

d. Base Support Impacts.

2.4.1 Construction Costs and Schedule Impact. The main indicator of resource implications for the siting of STC II or STC II plus SOPC at each base can be evaluated by the development of associated facility delta costs. These delta costs for each base and site, together with a discussion of schedule impact, are presented below.

2.4.1.1 Baseline Construction Costs. STC II and STC II/SOPC "ideal site" estimated construction costs were presented in the study report, "Facility Concepts for Satellite Control Facilities, Space Transportation System Mission Control Studies and Global Positioning System," dated August 1977. These costs were derived by applying typical unit costs per square foot of floor plan area for each cost category or type involved. This method of estimating must be used until the facility design has advanced sufficiently to permit more detailed estimates to be made. These costs are being used as the baseline facility acquisition costs - STC II at $55.7 million and STC II/SOPC at $70.0 million. These costs were based on Los Angeles area FY 81 MCP dollars.

2.4.1.2 Facility Delta Costs. The delta costs have been developed for each site and reflect, in general, the facility construction implications for that siting of STC II and STC II/SOPC. An explanation of the major elements of these costs is discussed in the following subsections.

2.4.1.2.1 Luke AFB, Arizona. Site 2. The delta costs for this site are associated with: (1) the requirement for 5 miles of two-lane access road; (2) additional electrical transmission lines; (3) acquisition of water wells and provisions for appropriate treatment, and (4) additional heating, ventilation and air conditioning needs.

2.4.1.2.2 Luke AFB, Arizona. Site 1B. The delta costs for this site are associated with the same requirements as for Site 2 but to a lesser degree, since only the antennas would be located at the Auxiliary field. Additional buildings, roads, fencing and cable trenches would also be needed over the baseline Site 1A requirements.

2.4.1.2.3 Luke AFB, Arizona. Site 1C. The delta costs for this site are derived from requirements similar to those for Site 1B; however, the extent of roads and cable trenching needed would depend on the specific location of the antenna field.

2.4.1.2.4 Nellis AFB, Nevada. The delta costs for this site are primarily associated with: (1) construction of a new sewage treatment plant; (2) additional heating, ventilation, and air conditioning needs; (3) additional electrical transmission lines; (4) a new water main and booster station; and (5) a new gas line.

2.4.1.2.5 Hill AFB, Utah. The delta costs for this site are primarily associated with: (1) additional site work, (2) cable trenches, and (3) added electrical transmission lines.

2.4.1.2.6 Mountain Home AFB, Idaho. The delta costs for this site are primarily associated with: (1) additional electrical transmission lines and transformers; (2) upgrading the existing two-lane access road; (3) upgrading water, sewer, and gas mains; and (4) additional heating, ventilation, and air conditioning requirements.

2.4.1.2.7 Malmstrom AFB, Montana. The delta costs for this site are primarily associated with: (1) upgrading two miles of existing 10' perimeter road; (2) upgrading utilities, water, sewage, gas and drainage; and (3) additional electrical transmission lines.

2.4.1.2.8 Kirtland AFB, New Mexico. The delta costs for this site are primarily associated with: (1) upgrading access roads; (2) installation of seven miles of water lines with necessary pumps and treatment equipment; (3) a new sewage treatment plant, including lagoons; (4) installation of two miles of electrical transmission lines with transformers and switchgear; and (5) enlargement of heating, ventilation, and air conditioning plant for the climate at this site.

2.4.1.2.9 Buckley ANGB, Colorado. The delta costs associated with this site are as follows: (1) upgrading the existing perimeter road and two miles of access road; (2) installation of new perimeter roads and additional new access roads; (3) clearing, grubbing and grading of 15 acres; (4) providing cable trench for fiber-optics cables for two remote antennas; (5) digging two water wells and installation of pumps and water treatment facilities; (6) installation of a new sewage treatment plant; (7) laying of six thousand (6,000) feet of natural gas lines; (8) installation of storm drains, road culverts and channeling of creek; (9) installation of ten miles of electrical transmission with necessaary transformers and switchgear; (10) additional heating, ventilation, and air conditioning at the site; and (11) providing additional foundations to reach bedrock for technical building, power plant, and antenna bases.

2.4.1.2.10 Peterson AFB, Colorado. The delta costs for this site include installation of the following facilities: (1) water lines with necessary pumps and connections; (2) branch natural gas lines; (3) storm drains and culverts; (4) one mile of electrical transmission lines with necessary switchgear; (5) sanitary sewers; and (6) additional heating, ventilation, and air conditioning for the climate at the site.

2.4.1.2.11 Offutt Air Force Base, Nebraska. The delta costs for Offutt AFB are primarily associated with: (1) a larger than baseline area to accommodate a special configuration; (2) demolition and removal of five small structures; (3) installation of utilities to site; (4) fill to raise building elevations a minimum of 3 feet above flood plain; (5) installation of a new transmission line and substation; (6) installation of a perimeter road, fencing and area lighting; (7) special cathodic protection; and (8) additional heating, ventilation and air conditioning equipment for the local climate condition.

2.4.1.2.12 Duluth International Airport, Minnesota - Site 2. The delta costs associated with Site 2 at Duluth IAP are primarily associated with: (1) larger than baseline area required because of terrain and nearby patches of swampland; (2) upgrade access roads to site; (3) install utilities on site; (4) provide additional fuel oil storage; (5) install secondary roads (perimeter, access road to airfield area); (6) install additional fencing and lighting; (7) provide strengthened roof structures to withstand severe snow loads; and (8) provide additional heating, ventilation and air conditioning for climate conditions.

2.4.1.2.13 Duluth International Airport, Minnesota - Site 1. The delta costs for Site 1 at Duluth IAP are associated with the same requirements as for Site 2 except to a lesser degree, since only the antennas would be located at the Site 2 area remote from the main buildings. In addition, refurbishment of existing buildings, installation of fiber optics cable trench and conduit, relocation of access road to U.S. highway 53, and installation of a new road to antenna field would be needed over and above the Site 2 requirements.

2.4.1.2.14 Hancock Field, New York. The delta costs for Hancock Field are primarily associated with: (1) refurbishing existing buildings; (2) installation of fiber-optics cable trenches and conduit to remote antenna field; (3) install additional fencing, lighting and perimeter patrol roads; (4) install new transmission line and substation; (5) relocate base entrance gate and access road; (6) relocate base security police building; (7) install new by-pass road around antenna field; and (8) provide additional heating, ventilation and air conditioning for the local climate conditions at this site.

2.4.1.3 Escalation and Area Cost Factors (ACF). The costs reflected in the table are corrected for escalation and site cost factors. Escalation has been accomplished in compliance with USAF FY 80-85 Military Construction Program (MCP) Guidance No. 1, dated 24 January 1978, as amended. The Area Cost Factors (ACF) shown in this same guidance were discussed with HQ AFSC to clarify their applicability to this evaluation. HQ AFSC suggested that individual bases be asked for

recommendations on the ACFs to be used for their base. This resulted in the following ACFs.

Los Angeles AFB	- 1.07	Kirtland AFB	- 0.92
Luke AFB Site 1	- 1.01	Buckley ANGB	- 1.00
Luke AFB Site 2	- 1.11	Peterson AFB	- 1.00
Nellis AFB	- 1.08	Cheyenne Mt. Complex	- 1.07
Hill AFB	- 1.05	Offutt AFB	- 0.95
Mt. Home AFB	- 1.20	Duluth IAP	- 1.15
Malmstrom AFB	- 1.15	Hancock Field	- 1.06

2.4.1.4 Total Construction Cost Calculations. The total construction cost at each site is obtained by adding the site delta costs to the baseline cost plus 5% of this sum for contingencies and 5% more for supervision, inspection, and overhead, all multiplied by the specific site corrected cost factor (CCF). The CCF is obtained by dividing the ACF for each site by the value for Los Angeles (1.07). The CCF for each site is as follows:

Los Angeles AFB	- 1.00	Kirtland AFB	- 0.86
Luke AFB ite 1	- 0.94	Buckley ANGB	- 0.93
Luke AFB Site 2	- 1.04	Peterson AFB	- 0.93
Nellis AFB	- 1.01	Cheyenne Mt. Complex	- 1.00
Hill AFB	- 0.98	Offutt AF	- 0.88
Mt. Home AFB	- 1.12	Duluth IAP	- 1.08
Malmstrom AFB	- 1.08	Hancock Field	- 0.99

2.4.1.5 New Construction Costs. Cost estimates shown in Table 2-6 are for the "all new" construction of STC II and STC II/SOPC facilities. The baseline facility acquisition costs of $55.7M for STC II and $70.0M for STC II + SOPC mentioned in paragraph 2.4.1.1 were derived by taking the baselines of $50.5M and $63.5M respectively and adding 5% for contingencies and then 5% more for supervision, inspection, and overhead. All costs are in FY 81 MCP dollars.

Table 2-6. All New Construction Cost Estimates

Base	Baseline Costs ($M)	Baseline Delta Costs (M)	Corrected Plus Delta Costs ($M)	Total Cost Factor (CCF)	Costs* ($M)
			STC II		
Luke AFB (Site 2)	50.5	+3.554.0	1.04	62	
Nellis AFB	50.5	+1.2	51.71.01	58	
Hill AFB	50.5	+0.9	51.40.98	56	
Mt. Home AFB	50.5	+0.4	50.91.12	63	
Malmstrom AFB (Site 2)	50.5	+0.951.4	1.08	61	
Kirtland AFB	50.5	+2.0	52.50.86	50	
Buckley ANGB	50.5	+4.7	55.20.93	57	
Peterson AFB	50.5	+0.6	51.10.93	52	
Offutt AFB	50.5	+2.9	53.40.88	52	
Duluth IAP (Site 2)	50.5	+3.453.9	1.08	64	
			STC II/SOPC		
Luke AFB (Site 2)	63.5	+3.767.2	1.04	77	
Nellis AFB	63.5	+1.5	65.01.01	72	
Hill AFB	63.5	+0.9	64.40.98	70	
Mt. Home AFB	63.5	+0.6	64.11.12	79	
Malmstrom AFB (Site 2)	63.5	+1.064.5	1.08	76	
Kirtland AFB	63.5	+2.1	65.60.86	62	
Buckley ANGB	63.5	+4.8	68.30.93	70	
Peterson AFB	63.5	+0.7	64.20.93	66	
Offutt AFB	63.5	+3.6	67.10.88	65	
Duluth IAP (Site 2)	63.5	+4.367.8	1.08	81	

*See paragraph 2.4.1.4

2.4.1.6 Construction Costs for Use of SAGE Facilities. The construction costs associated with the use of existing SAGE buildings and the related new construction required to satisfy STC II and STC II/SOPC facility needs at Luke AFB, Malmstrom AFB, Duluth IAP or Hancock Field are given in Table 2-7. The SAGE buildings at each site are very similar, and therefore, are treated as identical for this initial evaluation. Each SAGE building contains approximately 90,000 square feet that must be altered in order to meet the requirements of the proposed project. The existing floor space must be expanded by construction of an addition of 125,000 square feet for STC II or 190,000 square feet for STC II/SOPC to provide the required technical/operational floor space. In addition, new buildings will be constructed for the engineering/administration (34,000 square feet for STC II or 39,000 square feet for STC II/SOPC) and support/warehouse (29,000 square feet) functions. The existing power plant must be altered and/or expanded.

2.4.1.7 Construction Costs for Cheyenne Mountain Complex. Estimates for construction costs at Cheyenne Mountain Complex are based upon the assumption that all the existing facilities will become available for conversion to the requirements of the STC II or the STC II/SOPC. Since the existing facilities do not provide adequate technical/operational floor space, it will be necessary to expand the interior facilities by 55,000 square feet of floor space for the STC II, or 110,000 square feet for the STC II/SOPC. The existing power house will require expansion by 5,500 square feet. In addition, a new building must be constructed outside the Complex entrance to provide 25,000 square feet of floor space for non-critical administrative functions. Two antenna site options are considered. Site 1A provides the facility configuration described above with the antennas located on top of Cheyenne Mountain. Site 1B changes the antenna location to Peterson AFB.

Table 2-7 Military Construction Program Costs (FY81 - $M) SAGE Buildings Rehabilitation

Facility	Base	Rehab. SAGE Bldg	New Const. at SAGE Site	Building Cost	Basic Remoted Antenna Field Cost	New Const. For Rem. Antenna Field	Remote Antenna Field Cost	Site Corr. Cost Factor (CCF)	Total Costs
STC 11	Luke AFB								
	Site 1A	12.2	33.2	45.4	-	-	-	0.94	47.05
	Site 1B	12.2	28.7	40.9	4.5	3.93	8.43	0.94/1.04[2]	52.05[3]
	Site 1C	12.2	28.7	40.9	4.5	3.75	8.25	0.94/1.04[2]	51.85[3]
	Malmstrom AFB								
	Site 1	12.8	32.9	45.7	-	-	-	1.08	54.42
	Duluth IAP								
	Site 1	12.8	37.2[4]	50.0	-	-	-	1.08	59.54[4]
	Hancock Fld.	12.8	36.2[4]	49.0	-	-	-	0.99	53.48[4]
STC 11/SOPC	Luke AFB								
	Site 1A	12.2	46.7	58.9	-	-	-	0.94[2]	61.04
	Site 1B	12.2	42.2	54.4	4.5	3.93	8.43	0.94/1.04[2]	66.04[3]
	Site 1C	12.2	42.2	54.4	4.5	3.75	8.25	0.94/1.04[2]	65.84[3]
	Malstrom AFB								
	Site 1	12.8	46.8	59.6	-	-	-	1.08	70.97
	Duluth IAP								
	Site 1	12.8	50.2	63.0	-	-	-	1.08	75.03[4]
	Hancock Fld.	12.8	49.2	62.0	-	-	-	0.99	67.67[4]

[1]Total Costs: See paragraph 5.4.1.4.

[2]Cost factors of 0.94 used for Luke main base construction and 1.04 for Luke remote locations.

[3]These figures are strictly MCP and do not include acquisition of additional terminal equipment and increased O&M costs of $0.7M per year. For Luke Site 1B, near term equipment acquisition costs are $2.2M with an additional $2.3M required in the far term. In addition, far term MCP costs at Luke Site 1B amounts to $4.0M. For Luke Site 1C, near term equipment acquisition costs are $0.8M with an additional $0.1M required in the far term.

[4]The additional terminal equipment acquisition costs for Duluth IAP Site 1 is $1.12M, and for Hancock Field is $0.10M.

2.4.1.7.1 The construction costs associated with each of these two site configurations are as follows (in FY 81 $M):

a. Site 1A (Antennas on top of mountain).

ITEM		STC II	STC II/SOPC
1.	Refurbishment of existing buildings	$ 24 M	$ 24 M
2.	Expansion of Mountain interior	27 M	52 M
3.	Construction of new buildings (interior)	10 M	20 M
4.	Increase air conditioning system	10 M	19 M
5.	Install uninterrupted power system (UPS)	4 M	7 M
6.	Site development and install utilities exterior	6 M	6 M
7.	Construction of support building	3 M	3 M
8.	Antenna field site development and data link construction	14 M	14 M
	Site 1A Total MCP $ 98 M	$ 145 M	

b. Site 1B (Antennas on Peterson AFB)

1.	Same building configuration as for Site 1A $ 84 M	$ 131 M	
2.	Antenna field construction	8 M	8 M
3.	Provide fiber-optics cable trenches, conduit and repeater buildings (far term)	2 M	2 M
4.	Cost of right-of-way (far-term)	2.4 M	2.4 M
	Site 1B Total MCP $96.4 M	$143.4 M	

2.4.1.7.2 The foregoing MCP costs do not include the additional data communications link terminal equipment acquisition costs associated with each site. These costs amount to $0.1M total for Site 1A. For Site 1B, near-term equipment acquisition costs are $2.2M with an additional $2.2M required in the far-term. Increased O&M costs amount to $0.7M per year for either site. If existing floor space within the complex is not made available for the STC II or STC II/SOPC, new hard-rock excavation and construction would increase the total cost of the complete facility to over $300 million.

2.4.1.8 Design Schedule Impact. The design schedule for STC II and STC II/SOPC facilities will be basically the same, regardless of site or base. The requirement is included as a candidate line item in the FY 81 Military Construction Program (MCP). When selected as a USAF PRIME Project, design of this project would be initiated in early CY 79. It is estimated that the design effort would take from 12-15 months.

2.4.1.9 Construction Schedule Impact. Since this requirement is reflected in the FY 81 MCP, the availability of construction funds for approved projects can be anticipated around January 1981. The time required for advertising, awarding, and negotiating the contract(s) will result in a construction start date of April-May 1981. Construction time will vary in favor of the more southerly sites due to their year-round construction seasons and relative freedom from weather-related delays. Overall construction time should be in the 18-24 months time period. The SAGE sites should not require any longer construction times than new construction at Luke AFB or Malmstrom AFB. It would be advisable, however, to keep the powerhouses and related mechanical systems in operation throughout the construction period to avoid deleterious effects of inactivity on these systems. While this consideration should not lengthen the construction period, it will add to overall O&M costs; however, it will avoid even larger refurbishment and possible replacement costs.

2.4.1.10 Candidate Sites Construction Cost Summary. In summary, the total estimated construction costs for each of the candidate sites is as follows (FY 81 $M):

SITE	STC II	STC II/SOPC
1. Luke AFB (Site 1A)	$ 47 M*	$ 61 M*
2. Luke AFB (Site 1B)	52 *	66 *
3. Luke AFB (Site 1C)	52 *	66 *
4. Luke AFB (Site 2)	62	77
5. Nellis AFB	58	72
6. Hill AFB	56	70
7. Mountain Home AFB	63	79
8. Malmstrom AFB (Site 1)	54	71
9. Malmstrom AFB (Site 2)	61	76
10. Kirtland AFB	50	62
11. Buckley ANGB	57	70
12. Peterson AFB	52	66
13. Cheyenne Mt. Complex S (Site 1A)	98	145

14. Cheyenne Mt. Complex (Site 1B)	92 *	139 *
15. Offutt AFB	52	65
16. Duluth IAP (Site 1)	60	75
17. Duluth IAP (Site 2)	64	81
18. Hancock Field	63	68

* Near term.

2.4.2 Operational Support (Utility Costs). The costs for annual energy consumption will vary from base to base. These costs, including electricity, fuel oil, natural gas and water have been developed for the first year of operation and for the uniform or average cost per year for a 10-year life cycle.

	STC II		STC II/SOPC	
Base	1st Year	Uniform	1st Year	Uniform
Luke AFB Site 1A	1.278	2.134	1.870	3.123
Luke AFB Site 1B	1.521	2.539	2.113	3.528
Luke AFB Site 1C	1.521	2.539	2.113	3.528
Luke AFB Site 2	1.308	2.172	1.912	3.173
Nellis AFB	0.878	1.464	1.302	2.172
Hill AFB	0.629	1.046	0.930	1.549
Mt. Home AFB	0.395	0.652	0.556	0.920
Malmstrom AFB Site 1	0.288	0.475	0.401	0.662
Malmstrom AFB Site 2	0.289	0.476	0.402	0.663
Kirtland AFB	0.965	1.581	1.375	2.261
Buckley ANGB	0.605	1.005	0.876	1.458
Peterson AFB	0.751	1.249	1.056	1.758
Cheyenne Mt Complex	0.748	1.231	1.012	1.664
Offutt AFB	0.585	0.971	0.792	1.316

Duluth IAP	1.096	1.827	1.495	2.492
Hancock Field	0.905	1.505	1.218	2.028

2.4.3 Communications Costs. Except in the case of Hill AFB, Kirtland AFB, and Offutt AFB, the estimated costs shown below are associated with both the operational and administrative communications systems that will be leased from the local telephone company. The cost for Hill AFB, Kirtland AFB, and Offutt AFB reflect the expected cost of a leased/government furnished equipment (GFE) communications mix. Other communications equipment costs (such as DCA terminals, DSIS equipment, etc.) will not vary from site to site.

Costs in FY 78 Dollars

	Installation ($K)		Recurring/Year ($K)	
Luke AFB (Site 1)		625	500	
Luke AFB (Site 2)		975	500	
Nellis AFB	420	450		
Hill AFB	1,500	250		
Mountain Home AFB		415	430	
Malmstrom AFB	360	450		
Kirtland AFB	1,500	250		
Buckley ANGB	430	682		
Peterson AFB	440	858		
Cheyenne Mountain		616	637	
Offutt AFB	1,500	250		
Duluth IAP	665	1,228		
Hancock Field	1,749	1,573		

2.4.3.1 Installation costs for Luke AFB, Sites 1B and 1C would be slightly greater than for Site 1A. Installation costs for Luke AFAB, Site 2, include estimated cost for communications link from the site to Luke AFB. This would provide for an alternate routing capability from the site. The installation costs at Hill AFB, Kirtland AFB, and Offutt AFB reflect a leased/GFE communications mix. Installation costs for these three sites are best estimates since detailed costs have not been established by local telephone companies for many of the special telecommunications services required. Recurring costs include part of the system leased costs and a small amount for maintaining the

GFE system. It should be noted that installation costs for Cheyenne Mountain, Duluth IAP, and Hancock Field could be less than indicated. This will depend on how much of the existing systems installed can be used in the proposed facility.

2.4.4 Base Support Impacts. All bases (with Lowry AFB in support of Buckley ANGB) are capable of providing adequate support for both the new personnel and the mission--but not without some impacts. Impacts will primarily be manpower related, but there may also be requirements for new facilities, new equipment, and changes in schedules, and, at two bases, a potential requirement for the AFSCF to act as the host performing the base support role.

2.4.4.1 To determine a precise manpower impact, several factors must be taken into account, including base population, workloads in each support area, and special tenant requirements. When planning five to six years in advance, it is difficult to predict what changes will occur that may affect these factors. Therefore, a Base Operating Support (BOS) factor (reference AFR 173-10) is generally used to predict manpower impacts. Using a BOS of a 16.7% of the expected military and civilian population, the normal support population of each base is expected to increase by 94 people. One additional person might be required in the Security Police Squadron to support the increase in requirements for vehicle decals and security badges required by contractor personnel.

2.4.4.2 If the proposed project is sited at either Duluth IAP or at Hancock Field, STC II, as the largest activity located at the base, might be required to assume the function of host. It is presumed that if this occurs, the present support personnel and functions would be assigned to the SCF. The SCF would than be required to program for the related costs and obtain the necessary O&M funds. The estimated yearly fund requirements are $16M for Duluth and $12M for Hancock. See Table 2.8.

Table 2-8 Base Support Costs

	# Spt Personnel		Annual Salaries		O&M	Total
	Mil	Civil Service	Mil	Civil Service		
Duluth IAP	693	216	$7.6M	$4.2M	$4.6M	$16.4M
Hancock Fld	470	218	$5.7M	$3.0M	$3.3M	$12.0M

2.4.4.3 Housing of all types is in short supply at all bases, with the exception of Kirtland AFB where family units and enlisted quarters are presently available. Nevertheless, it is considered that with proper planning, the civilian communities surrounding bases, with the exception of Mountain Home AFB, can absorb the influx of additional personnel required for this project with little or no impact on the existing amenities of the areas. The greatest impact is expected at Mountain Home AFB. Because of the small population of the surrounding community, special consideration should be given here to constructing additional family housing on base for use of military personnel.

2.4.4.3.1 In order to feed the increased enlisted population in the dining halls, an extension of meal hours might be required. The dining hall at Buckley ANGB will require enlargement and authorization to accommodate all station personnel.

2.4.4.3.2 At some bases, especially Hill AFB and Buckley ANGB, additional printing and reproduction equipment might be required. If printing requirements cannot be accommodated by existing base equipment, then any additional equipment should be located in the new facility.

2.4.4.3.3 If the Auxiliary 1 site at Luke AFB is selected for either the entire facility or antenna field only, a fire station will be required. If the antenna field only is located at some off-base site closer to the main base, a fire station will probably be required; however, this would depend on distance and access from the main base fire station. Fire fighting equipment may either be relocated from other stations or new equipment procured.

2.4.4.3.4 If Site 1 at Kirtland AFB is selected, additional water lines for fire protection may be required.

2.4.4.3.5 The fire department at Peterson AFB will require an additional 3 to 4 personnel to support this project. Security Police at Peterson have a law enforcement role, thus no specialists in security techniques are currently assigned. To support this requirement the police force squadron must be augmented with security specialists.

2.4.4.3.6 The U.S. Army at Fort Carson provides fire fighting support to the Cheyenne Mountain Complex. With the increased size of the proposed project, it might be required that a new fire station be constructed near the complex entrance.

2.4.4.3.7 It may be necessary to hire a civilian or contractor guard force at Buckley ANGB to provide the additional personnel, access, control and perimeter patrols, unless a military security force is assigned. In general, personnel support is very limited at Buckley. If this site is selected, extensive host tenant agreements will be required with Lowry AFB in addition to those with Buckley ANGB. Such support from Lowry is dependent upon its continuing status as an operating base with the required facilities remaining available for this project.

2.4.4.3.8 Hancock Field is currently receiving support from Griffis AFB including the areas of procurement, accounting, finance and base supply. If Hancock is selected for the proposed project, it is expected that this arrangement would continue and possibly expand to include information, management analysis, and intelligence collection. At all bases, authorizations for new motor pool vehicles may be required.

2.4.4.3.9 None of the above impacts of STC II on the bases is considered significant. Once a site is chosen, the impacts can be resolved through negotiation of the host-tenant agreement. The impact on the AFSCF budget of assuming the host role at Duluth or Hancock would, of course, be significant.

ANNEX C

CONSOLIDATED SPACE OPERATIONS CENTER

SITE SELECTION - OPERATIONAL AND ORGANIZATIONAL FACTORS

ANNEX C
CSOC SITE SELECTION
OPERATIONAL AND ORGANIZATIONAL FACTORS

1.0 Introduction: Site survey 79-26 evaluated each of the candidate sites against technical and environmental criteria, construction cost, facility usage and base operating support. Not considered in the initial survey were operational and organizational factors which are site dependent and which effect the efficiency, effectiveness and life-cycle costs of the Consolidated Space Operations Center (CSOC). During the Air Staff review of the site survey these operational and organizational concerns were voiced. Consequently, the Air Staff solicited and evaluated CINCAD's views on the operational and organizational advantage/ disadvantage of locating the CSOC at each of the candidate sites, specifically the effects resulting from the geographical proximity of the CSOC with the Space Defense Operations Center (SPADOC).

1.1 Background: The SPADOC located in the Cheyenne Mountain Complex (CMC) (in the Colorado Springs area) became operational on 1 Oct 79. The SPADOC will evolve into the command, control and communications center for space defense for the U.S., interfacing with DOD, national and civil space systems. As such, its mission is threefold: surveillance of space activities to identify abnormal or hostile events; protection of US space assets from hostile acts; and negation of hostile space assets. Performance of the first two tasks requires close coordination with US spacecraft operators. Identification of hostile or abnormal space activities requires current knowledge of space activities, both US and foreign. Active and close coordination between SPADOC and the CSOC (which with its companion, the Satellite Test Center, operates 80% of the DOD spacecraft) will provide a substantial source of input data to the SPADOC on planned and in-progress US military and space operations.

1.1.1 Protection of US space assets requires knowledge of hostile actions, current US space operations, threat capabilities and US passive and active counter-measure effectiveness. Active and close coordination between SPADOC and CSOC will provide the necessary data exchange to identify hostile actions in progress, identify possible target(s), and compare threat with countermeasure capability to recommend/select the appropriate response. It is by the nature of this intimate relationship between CSOC and SPADOC and the similarities of the space operations functions that are conducted at these facilities that operational and organizational advantages accrue from their geographical proximity, and which must be weighed in an evaluation of a site for CSOC.

1.2 Operational: Among the operational advantages are the increases in efficiency and effectiveness, and life-cycle cost reductions that could be achieved through geographical proximity. Several examples are described which are illustrative of the kind of potential savings available.

1.2.1 Efficiencies

1.2.1.1 The first of these efficiencies can be achieved through the sharing of technical support facilities, due to the geographical proximity of CSOC to the CMC. A communications terminal is currently programmed for installation in 1982 in the Colorado Springs area for support of the CMC. The CSOC configuration also requires such a terminal for communication with the Remote Tracking Stations (RTS's). Locating the CSOC in the Colorado Springs area eliminates the need for a CSOC terminal, avoiding military construction and hardware acquistions cost, as well as the recurring cost of military manpower and O&M cost. Both Kirtland AFB and Malmstrom AFB do not have or are programmed for such a terminal.

1.2.1.2 Sharing the already programmed DSCS-EASTPAC terminal will result in cost savings of $2.4M in military construction funds and $5.3M in hardware procurement funds (FY 79$). This total of $7.7M is a direct offset to differential MCP costs between Peterson and Kirtland/Malmstrom identified in Appendix B. Shared O&M costs for this will allow a savings of 20 enlisted personnel in grades E-3 to E-9 at an annual pay savings of $228,000 or $2.3M for a 10 year life cycle cost avoidance (FY 79$). Also these personnel savings occur in an extremely critical career field (304X6) and the shared terminal will help alleviate a shortage in this specialty. Additionally, shared O&M costs for this terminal show a cost avoidance of $3.255M (FY 79$) for the terminal and subsystem support over a 10 year life cycle. Total potential cost avoidance available through sharing of CSOC is approximately $13M over a 10 year life cycle in FY 79 dollars.

1.2.1.3. A second example results from the centralization of scarce military manpower resources. Siting the CSOC in the Colorado Springs area will allow access to the existing blue suit space operations manpower pool (51XX, 20XX, 27XX, 28XX, 511XO), resident in HQ ADCOM at Peterson AFB and the CMC, providing the potential for manpower savings. No equivalent technical support base exists at Malmstrom. A comparable technical support base exists at Kirtland but it is oriented toward physics research (lasers, weapons effect) not space operations. Through the optimizations of this manpower pool with that required for CSOC, unnecessary duplication could be avoided. The level of savings could

vary widely dependent upon the degree of consolidation of like functions and is contingent upon command agreements. Recognizing that the personnel packages for SPADOC and CSOC have not been completed, the example cited estimates the possible savings of computer-oriented and other management overhead personnel between 10-24 blue suit positions. This is possible because computer system and software (orbital mechanics algorithms) requirements are similar and in many cases computational routines will be identical. Ten year life cycle cost savings are as shown (FY 79 $).

5-10 Capt))	computer programmers -	$2.05M to 4.1M
5-10 TSgt)		
3 Maj)		
)	other overhead -	1.07M
1 MSgt)		
TOTAL		$2.1M to $5.17M

1.2.1.3.1. Programmers: 5-10 (Capt) and 5-10 (TSGT). The CSOC manning projections call for 27 personnel in AFSC's 51XX and 511X0. There are 114 officer programmers and 84 enlisted programmers remaining in ADC after the ADCOM reorganization with five additional 51XX officers projected for SPADOC in 1982. There will also be 52 AFSC 511X0 personnel in SAC at Peterson. The actual numbers saved by sharing programmers is dependent upon computer selection and a more detailed concept of operations for CSOC. However through careful planning a savings of 10-20 appears to be realistic (savings $205K to 400K annually).

1.2.1.3.2. Overhead: Three Majors and one Msgt. Other mangement overhead. One liaison officer (Major for FAA, NSA, FTD, etc) could act for both CSOC and SPADOC. One security staff officer (Maj) could be shared with either SAC or ADC. Reduction of one duty software engineer (Major). One security chief (MSgt) can be shared with either the CMC or Peterson AFB (SAC) (Savings: 107.6K annually). There is the potential for additional management savings, however, the functional descriptions are not detailed enough at this point to be certain of these additonal positions.

1.2.1.4. Another efficiency is in the area of O&M cost avoidance. Several examples are illustrated below.

1.2.1.4.1. Consolidated Space Operations Center (CSOC) Manning, SD/CS Ltr, 14 Sep 79, identified 128 officers, and 190 enlisted personnel as the projected operational manpower for CSOC. A 4-year rotation would argue that approximately 25% of the military personnel would transfer (PCS) each

year. If the CSOC and SPADOC were located in geographical proximity, one could assume that somewhat less than 25% (15% is assumed to be a realistic figure) might transfer between CSOC and the SPADOC. This is based on the premise of maximizing use of space operations personnel in space operations jobs. If the CSOC and SPADOC were located in proximity, then a PCS savings could be realized as only a PCA would be required. Air Staff estimates range from $840K to $1.04M cost avoidance over a 10 year perod. (FY 80 PCS costs from AFP 173-13, Cost and Planning Factors Guide, 31 May 79 was used for cost between Peterson and Kirtland.)

1.2.1.4.2. An estimated 1 man-trip per week between SPADOC and CSOC was estimated for accomplishing the necessary planning, coordination and technical interface support required between these two facilities. Aproximately two work days per trip are lost due to travel alone that would not be lost if facilities were in geographical proximity. Over a 10 year life cycle this equates to 1040 man-days work (1 trip/wk X 52 X day/tri X 10 years) or 4.7 man-years. For costing purposes four man-years was used. Cost for a technical man-year is approximately $25K/yr, resulting in a cost saving of approximately $100K over a 10 year period.

1.2.1.4.3. Field Training Detachment (FTD) is needed to provide formal ATC training for entry level and follow-on qualification training for space operations and computer operations courses (approximately six week courses). FTD must be collocated with CSOC in order to ensure close interchanges of Ops and training requirements. Estimates show about 80% of turn-over will require this training each year. Since Peterson AFB already has an established FTD teaching these courses (Kirtland and Malmstrom does not) it was estimated that there would be a differential of two additional officers required to support the FTD if not located at Peterson AFB. Over a 10 year period this results in 20 man-year savings.

1.2.1.4.4 The potential cumulative cost savings in this O&M area (FY 79$) over a ten-year life cycle amounts to 1.4M to 1.6M dollars.

1.2.2 Effectiveness: The operational advantages accruing from geographical proximity of CSOC to SPADOC which increase effectiveness are not as easily quantified as those advantages previously discussed. In addition, the factors which increase effectiveness are judgmental in nature. For example, what is the value of face-to-face coordination in an age when space will be a crucial medium for military capabilities? The CSOC Management Concept requirement for close coordination between the SPADOC and CSOC for integrated operational planning and day-to-day operations, based on their interdependence and interrelationships, is enhanced

by a CSOC located at Peterson rather than Kirtland or Malmstrom. Coordination time is minimized while decision and reaction time is optimized, avoiding costs due to false starts and lost time.

1.2.2.1 For example, false starts and lost time represent a decrease in effectiveness in trying to establish and/or alter operational interfaces via TDY contacts. SPADOC operations will require substantial contact between SPADOC and CSOC. Attempting to maintain contact via TDY trips is limiting (infrequent and necessarily limited in number of personnel travelling). Geographical proximity facilitates worker level contact for immediate problem resolution.

1.2.2.2 Many of the requirements which drive the design of the CSOC are inherently the same as those for the SPADOC. The computer system and software (orbital mechanics algorithms) requirement are similar and in many cases computational routines will be identical. Communications links, terminal requirements (as cited earlier), automated switching and message handling also are expected to be similar, if not identical. While each of the facilities have separate and distinct missions, their intrinsic capabilities could be mutually supportive, and would allow cross-utilization of personnel if collocated or in geographical proximity.

1.2.2.3 The capability to calculate orbits for predictive avoidance in CSOC and SPADOC would allow the flexibility to run the program in SPADOC while CSOC is saturated with another high priority job or during a subsystem failure. During a subsystem or catastrophic failure, the perishable data tape from one computer could be taken across town to the other with little lost time in operations (as was done between CMC computers and the compatible computers on Ent AFB for Space Defense Center operations). Admittedly, those tapes could be converted to cards, AUTODINed to Malmstrom or Kirtland, converted back to tape and the program completed. However, this is undesirable from an operational viewpoint due to the extra time, which could render perishable data useless, and the greater probability of errors in the conversion processes.

1.2.2.4 Additionally, the requirement for CSOC interfaces with NMCC, WWMCCS and space/space-related activities would be simplified due to the presence of these existing interfaces in the SPADOC. In general, the opportunity to improve the management of resources, the facilitated operations planning, and coordination will lead to improved CSOC/SPADOC interfaces resulting in time-compressed decision-making and improved space order of battle.

1.3 Organizational: The space organization, today, as it applies to the Space Defense mission, is in a state of transition. By the mid-80's the Air Force will have a fully operational SPADOC, within the CMC, and CSOC, which with all its planned elements, will be a "de facto" command and control center for military space operations. The understanding of the value of the supporting organizational structure for space-based systems and operations will become increasingly clear. Unfortunately, because of acquisition lead times, we do not have the luxury of delaying a CSOC decision. So a decision must be made now on CSOC, while being careful not to foreclose future organizational options that could enhance effectiveness/efficiency of space systems and space operations later in the next decade. Therefore, the CSOC location must be made in light of future organizational options. Geographical proximity of CSOC and SPADOC preserves future organizational options - allowing the unification or further consolidation of space operations responsibility without the attendant relocation costs. It is the organizational structure that limits consolidation, and only the degree of consolidation/unification of space operations resources which limits the potential cost savings from the consolidation of facilities, management and command overhead, and technical support manpower.

1.3.1 Additionally, National, DOD and Air Force Policy/Directives support capitalization on CSOC's capabilities by functional/geographic consolidation including: the direction to pursue consolidation, avoidance of unnecessary duplication, and cross-utilization in the space arena. Draft DOD and Air Force directives specify consolidation and centralization of space operations.

1.3.2 Geographical proximity also offers other advantages. There is historical precedent within the Air Force for centers of technical excellence. For example, military aeronautical development activities have centered around Wright-Patterson Air Force Base. From this, then, the opportunity for establishing a military center for space operations is presented in the location of CSOC in the geographical proximity of SPADOC. Current space activities are primarily of a research and development nature and are carried out at centers geographically widely separated (Eastern Test Range, Vandenberg Air Force Base, Air Force Satellite Control Facility, and the Johnson Space Center).

1.4 Summary: The location of CSOC goes beyond the analysis of the technical, environment, base operating support, MCP cost and facility utilization factors. Although communications technology could provide a measure of connectivity between SPADOC and CSOC from any of the proposed locations, the operational and organizational benefits favor selecting Peterson. Operational factors, including preserving growth and organizational options, weigh heavily on the final decision. As has been shown in the illustrative examples, the life cycle costs easily amortize the differential in the estimated MCP costs. Over the life of the CSOC facility, which will be well in excess of 10 years, the cost savings from these examples alone will be substantial. Added to these increases in efficiencies are those advantages which increase the effectiveness of space operations. Although not as easily quantified, these advantages together with the organizational advantages substantially favor Peterson for location of the CSOC.

ANNEX B

HQ USAF REPORT ON

SITE SURVEY 79-26

FOR THE

CONSOLIDATED SPACE OPERATIONS CENTER

SEPTEMBER 1979

PREFACE

On August 9, 1979, SECAF directed the Air Staff to perform a detailed site survey on the most viable candidate sites for locating the Consolidated Space Operations Center (CSOC). The candidate sites selected were Malmstrom AFB, Great Falls, Montana; Peterson AFB, Colorado Springs, Colorado; and Kirtland AFB, Albuquerque, New Mexico. These sites were selected from twelve candidate sites assessed and reported in Site Survey 78-21, February-March 79 (SAMSO Document).

To aid in a siting decision, Site Survey 79-26 was performed by visiting each of the three candidate sites to update previous data; to determine the base support impact of CSOC on each of these candidate sites; to initiate environmental impact assessments; and to specifically identify existing facilities that could be used to reduce the need for new construction.

The following report presents the findings of Site Survey 79-26 conducted 4 Sep 79 through 12 Sep 79. Section I provides a description of the proposed candidate sites followed by an assessment of the sites in meeting the criteria in Section II and Section III presents environmental assessments. The report concludes in Section IV with the findings of the survey.

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I
DESCRIPTION OF CANDIDATE SITES

1.0 MALMSTROM AIR FORCE BASE, MONTANA (Strategic Air Command). Malmstrom AFB is located in the northwestern sector of Montana, four miles east of the city of Great Falls. Great Falls is located at the intersection of U.S. Highway 89 and U.S. Interstate 15. The population of Great Falls is currently in excess of 60,000; Malmstrom AFB has a resident population of about 5700. The base employs 5,675 military and civil service personnel, and is, by far, the largest single employer and purchaser of goods and services within the community. The main gate of the base is reached by traveling east on Second Street from Great Falls.

1.1 The 341st Strategic Missile Wing is the host unit at Malmstrom AFB. The mission of the wing is to operate and support four squadrons of Minuteman ICBMs. Other major units currently assigned to the base are Headquarters 24th Air Division (Aerospace Defense Command) and the SAGE Region Control Center (North American Air Defense Command).

1.1.1 Malmstrom AFB is housed on approximately 3,000 acres (Figure 1). In addition, missile complexes are located in a 24,000 square mile area surrounding the base.

1.1.2 Support facilities include a medical and dental clinic, extensive MWR facilities, Capehart, Wherry, and multi-unit family housing (1406 units), dormitories (1666 spaces), a 152-space mobile home park, and 112 government trailers.

1.2 Available Facilities. At Malmstrom AFB six existing facilities were offered for potential CSOC use (Figure 2). They are Building 145, now occupied by the SAMSO Det 29 Site Alteration Task Force (SATAF); Building 500, currently the SAGE block house; Building 1441, occupied by the Boeing Company; and Buildings 1708, 1443, and 1445, previously occupied by the 17th Defense Systems Evaluation Squadron. Buildings 1441, 1443, and 1445 are converted WW II hangars.

1.3 Proposed CSOC Location: Figure 3 depicts Option A (use of SAGE Facility), and Figure 4 depicts Option B (nonuse of SAGE Facility)

1.3.1 Option A: Option A uses an existing SAGE facility for Engineering and Administration (E&A). The SAGE facility is located at the intersection of Second Street and Avenue K. A new structure is required for technical activities. The antenna field for this facility would be located remotely in the southeast quadrant of the base.

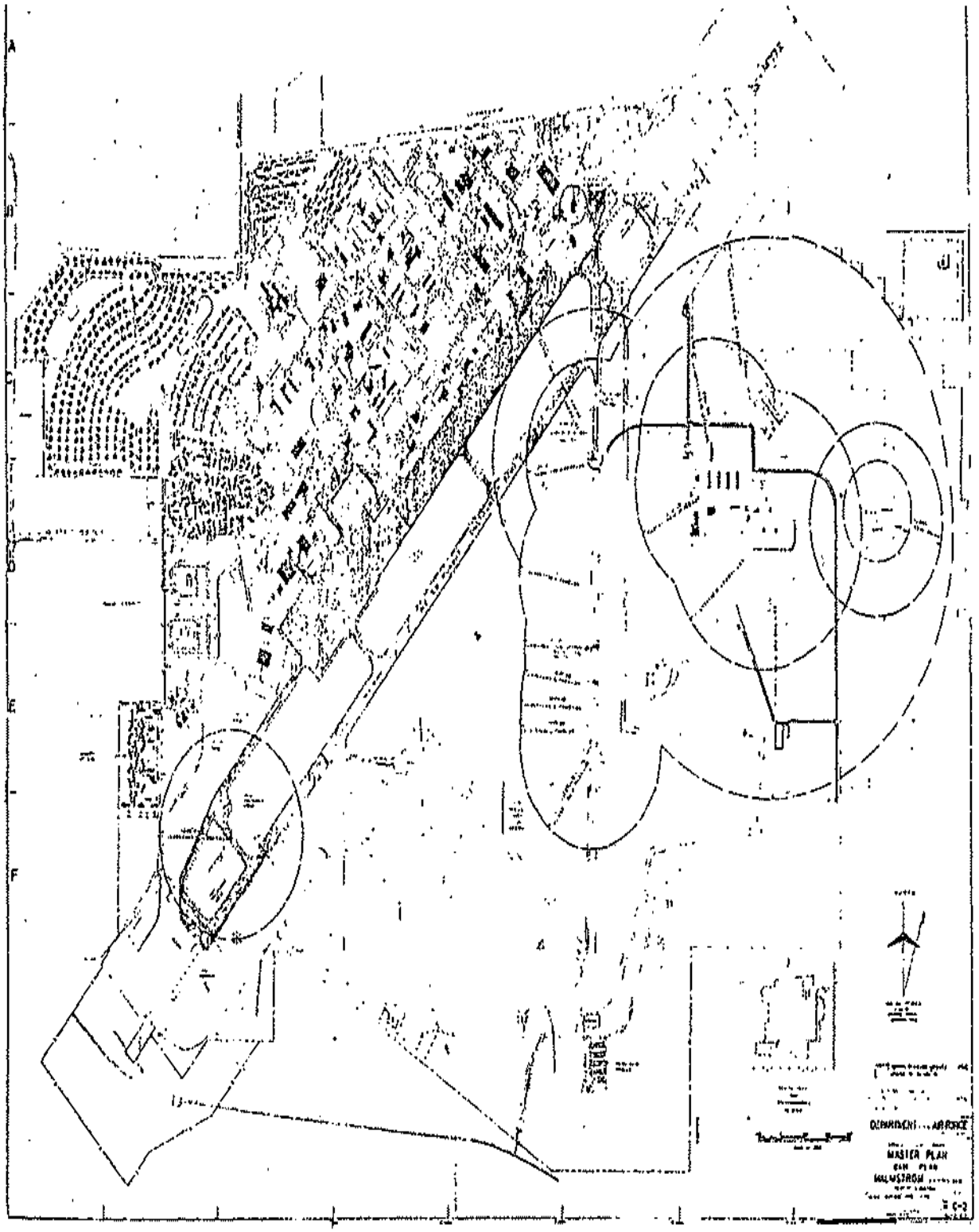


Figure 1. MALMSTROM AFB LAYOUT

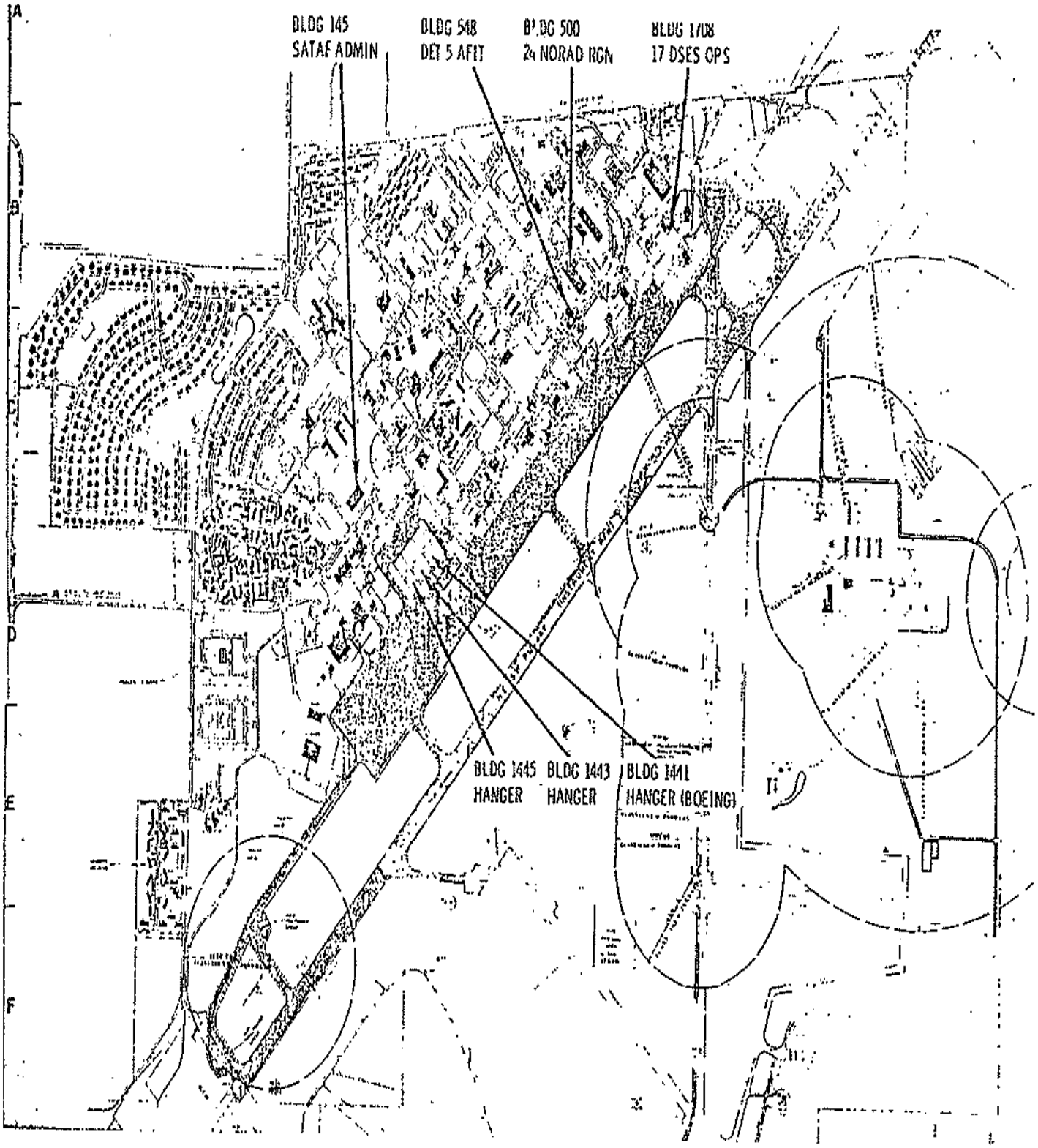


Figure 2. MALMSTROM AFB - AVAILABLE FACILITIES

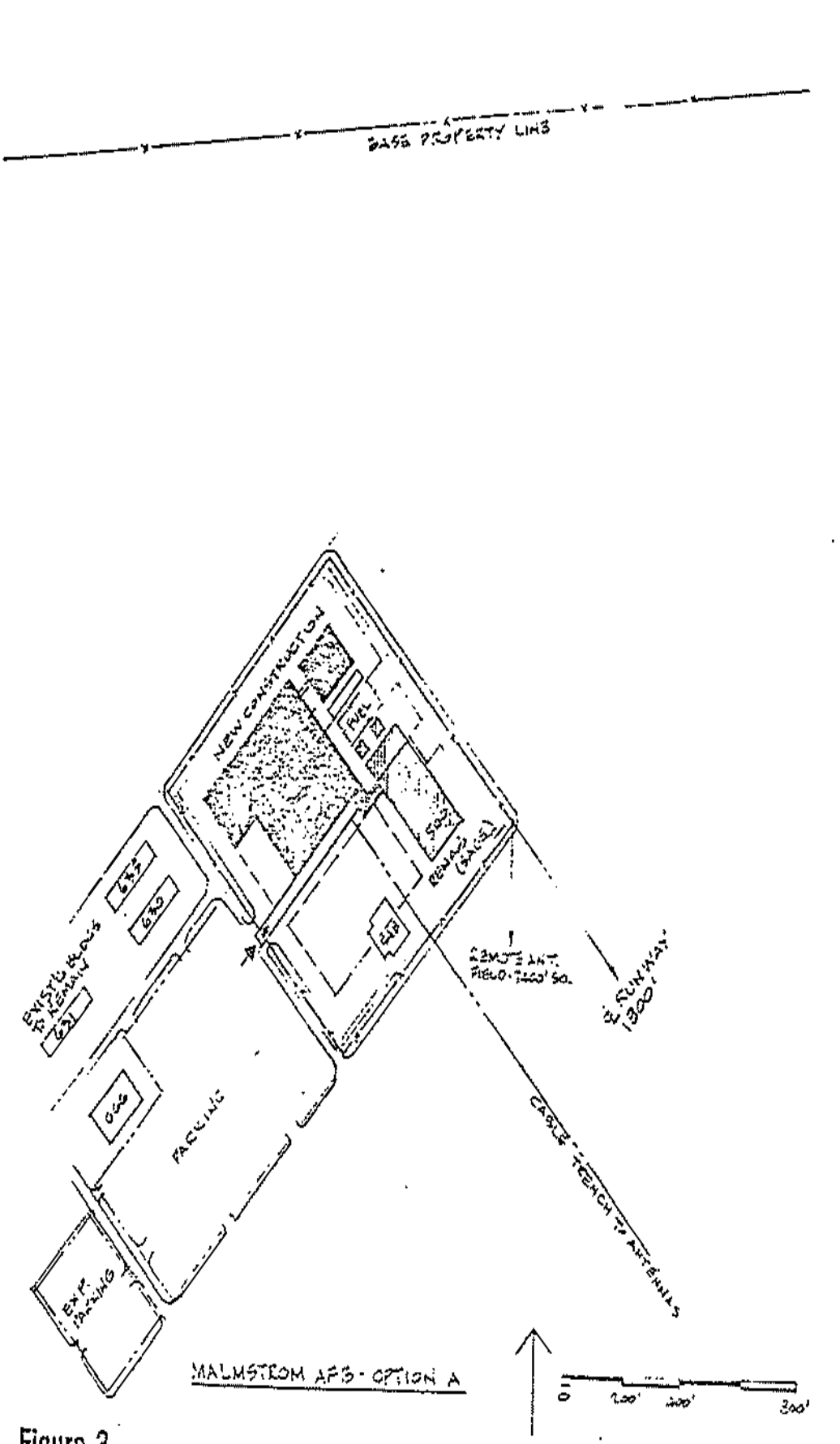
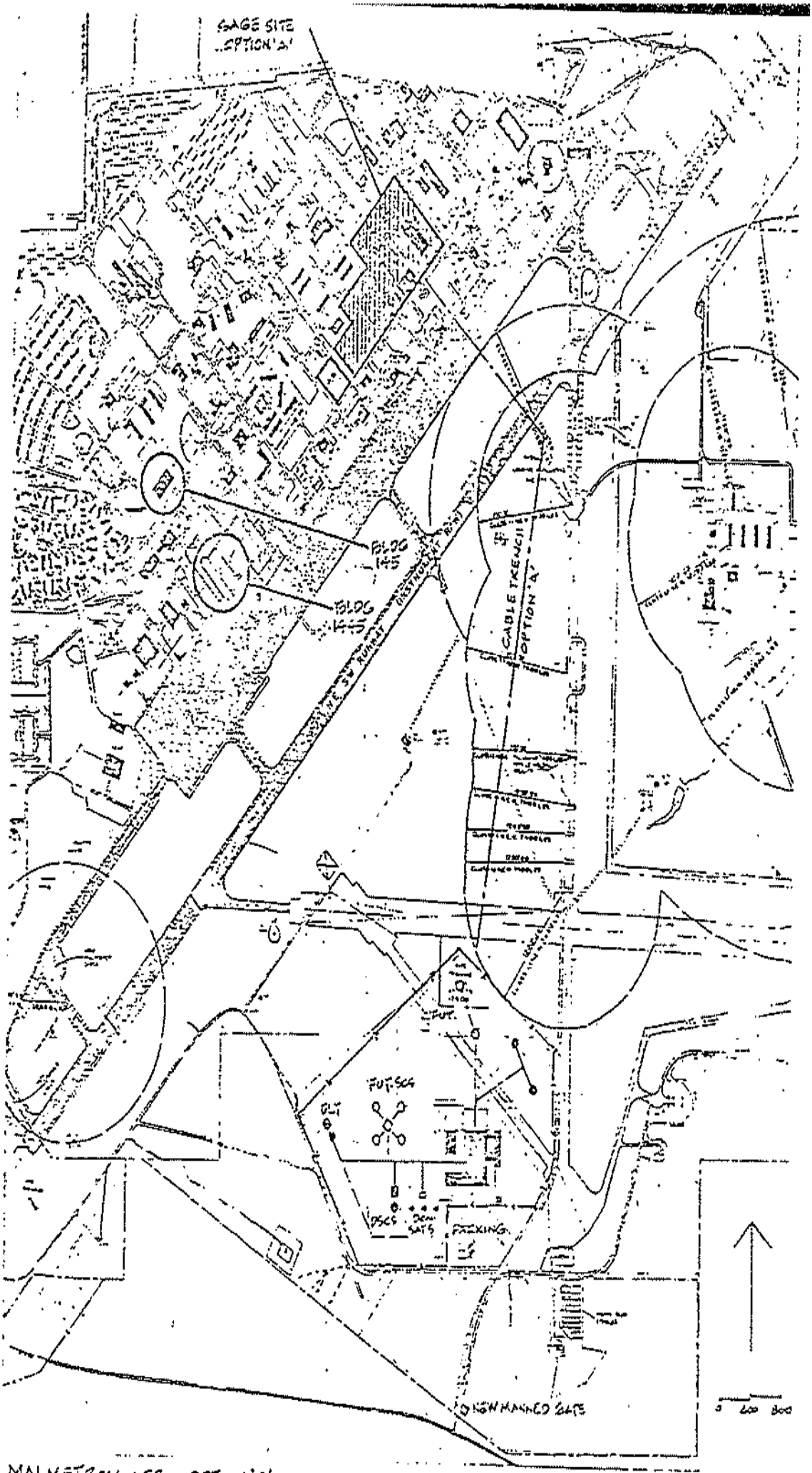

BASE PROPERTY LINE
NEW CONSTRUCTION
FUEL
SOS
REMAIN (BACK)
643
EXIST BLDGS TO REMAIN
631
630
646
PAVING
EXP PARKING
CABLE TRENCH TO ANTENNAS
MALMSTROM AFB - OPTION A
0
100'
200'
300'

Figure 3.



MALMSTROM AFB - OPTION 'B'

AND SITE OF REMOTE ANTENNAS FOR OPTION 'A'

Figure 4. 1-5

1.3.2 Option B: Option B locates the Technical/E&A facilities and antenna field in the southeast portion of the base. The facility is located on a 135-acre tract which is reached by a perimeter road. There is the potential for gate access adjacent to the site on the southeastern base boundary.

1.4 PETERSON AIR FORCE BASE, COLORADO (Aerospace Defense Command). Peterson Air Force Base is located approximately 10 miles east of downtown Colorado Springs, The population of Colorado Springs (metropolitan area) is currently in excess of 300,000; Peterson AFB has a resident population of about 1,650. The Colorado Springs region is economically very dependent on the region's military establishments; Peterson alone employs about 2640 military and civilian personnel. Military and federal civil service personnel assigned to military installations (35,805) comprise 29.8% of the Colorado Springs regional employment with the Peterson AFB complex accounting for 7.4% of the local military and civil service force.

1.4.1 The primary mission of the host unit at Peterson AFB, now the 46th Aerospace Defense Wing (ADCOM) and soon to be the 46th Air Base Wing (SAC) under the ADCOM Reorganization, is to operate and maintain on and off-base military facilities of the Peterson AFB complex and to provide administrative and logistical support to NORAD/ADCOM.

1.4.2 Peterson AFB is housed on about 1200 acres of land leased from the city of Colorado Springs through the year 2066. Peterson AFB is a tenant of the Colorado Springs Municipal Airport which has its terminal facilities located immediately west of the base. The airfield itself is jointly used by the base and the Municipal Airport. A new 13,500 foot north/south runway is planned by the Municipal Airport to be constructed on land adjoining the southeast perimeter of the base. Aircraft utilizing the airfield currently average 46 sorties per day (for military aircraft) and 19 per day (for commercial airliners). Both accident potential and noise zones have been mapped for the existing and projected air traffic.

1.4.3 The Peterson AFB complex consists of the base proper (Figure 5), the Chidlaw Building located in downtown Colorado Springs (which serves as the headquarters for the North American Air Defense Command - NORAD and the Aerospace Defense Command - ADCOM), the Federal Building located approximately three blocks from the Chidlaw Building and currently in partial use for support of the 427M, Cheyenne Mountain Complex Improvement Program, and the Cheyenne

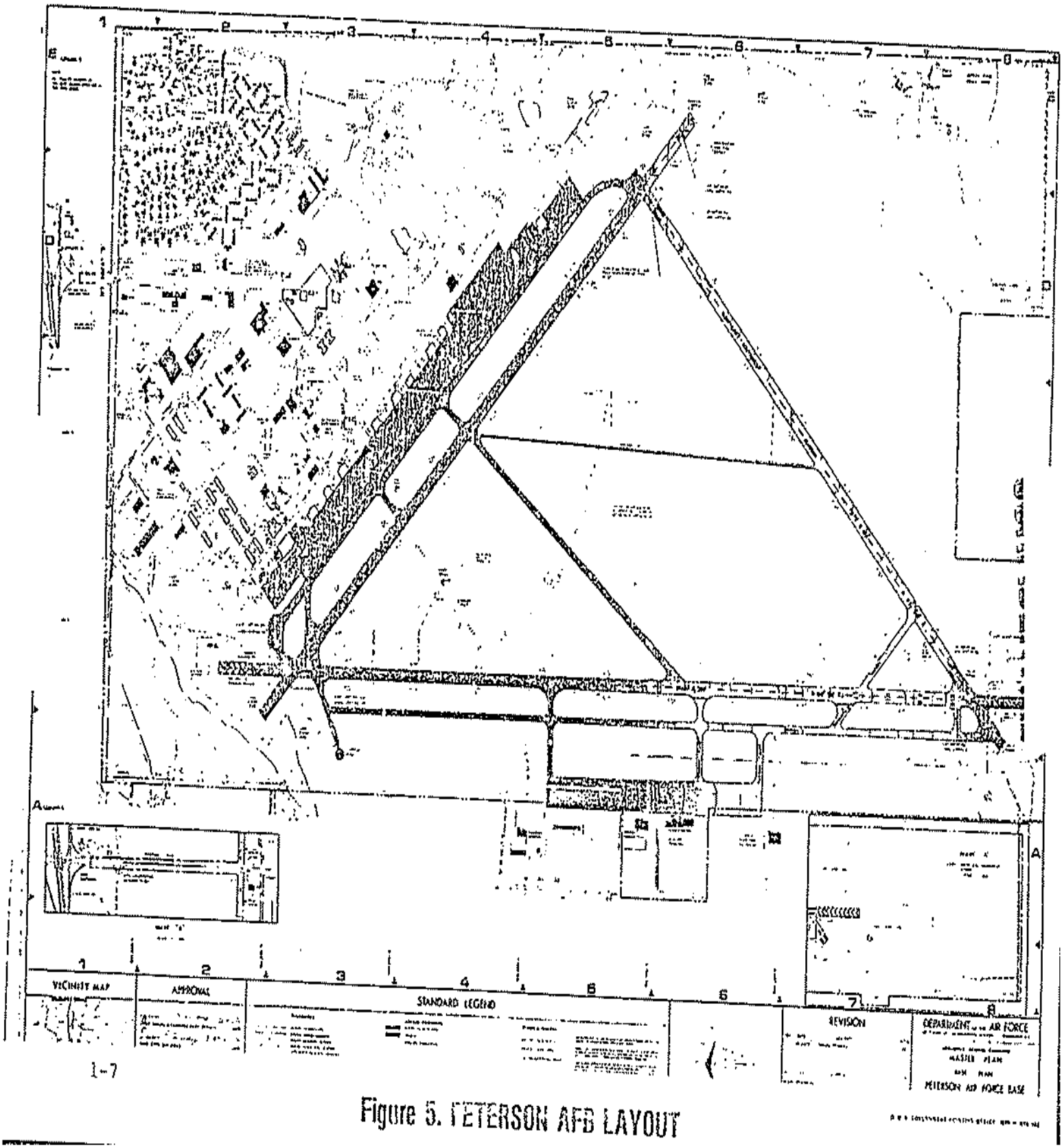


Figure 5. PETERSON AFB LAYOUT

Mountain Complex located five miles southwest of Colorado Springs. The Chidlaw Building is scheduled to be vacated under the ADCOM Reorganization with the remaining NORAD and ADCOM personnel moving to Peterson AFB and the Cheyenne Mountain Complex.

1.4.3.1 An extensive building program has been underway at Peterson over the past few years, resulting in one of the nation's most modern bases with support facilities equivalent to a moderate-sized city. Support facilities include a medical/dental clinic, extensive recreational facilities, a comprehensive education center, and the many other functions of a modern base. In addition to the wide range of support facilities, the base also has some of the most modern housing offered by any military installation, including men's and women's dormitories, 492 familiy housing units, and a 50 space mobile home park. A number of tenant missions are supported by Peterson, including the USAF Clinic, Air Force Communications Center, 12th Weather Squadron, Defense Communications Agency Operations Center/Support Division, and Canadian Forces Support Unit.

1.4.4 Available Facilities: Few existing facilities were identified at Peterson AFB (Figure 6) for potential CSOC use. Space is at a premium throughout the base because HQ NORAD/ADCOM functions are being transferred from the Chidlaw Building in downtown Colorado Springs to Peterson AFB as part of the ADCOM reorganization. Three existing facilities were identified and investigated for use by CSOC. They are Bldgs 114, 119, and 130. All are World War II vintage hangars, having steel frame construction with wooden roof trusses (except one has steel trusses) and sheet metal covering skin. Each has from 10,000 to 11,000 sq ft of floor area.

1.4.5 Proposed CSOC Location: Base personnel identified a number of locations in undeveloped areas of El Paso county, east of Peterson. After on-site inspections, both from the air and ground, a candidate location was selected within ten miles by local roads from Peterson AFB. The candidate locations are situated within a large parcel of land in the southeast corner of the county. Two are owned by the state of Colorado and one is under private ownership (Figure 7). There is evidence of a small sub-division of land about one mile south of the state owned land, but generally the facility would be remote from residential areas and all but very low traffic volume county roads. The present use of the land is livestock grazing. Highway 94, which runs east-west just north of Peterson AFB

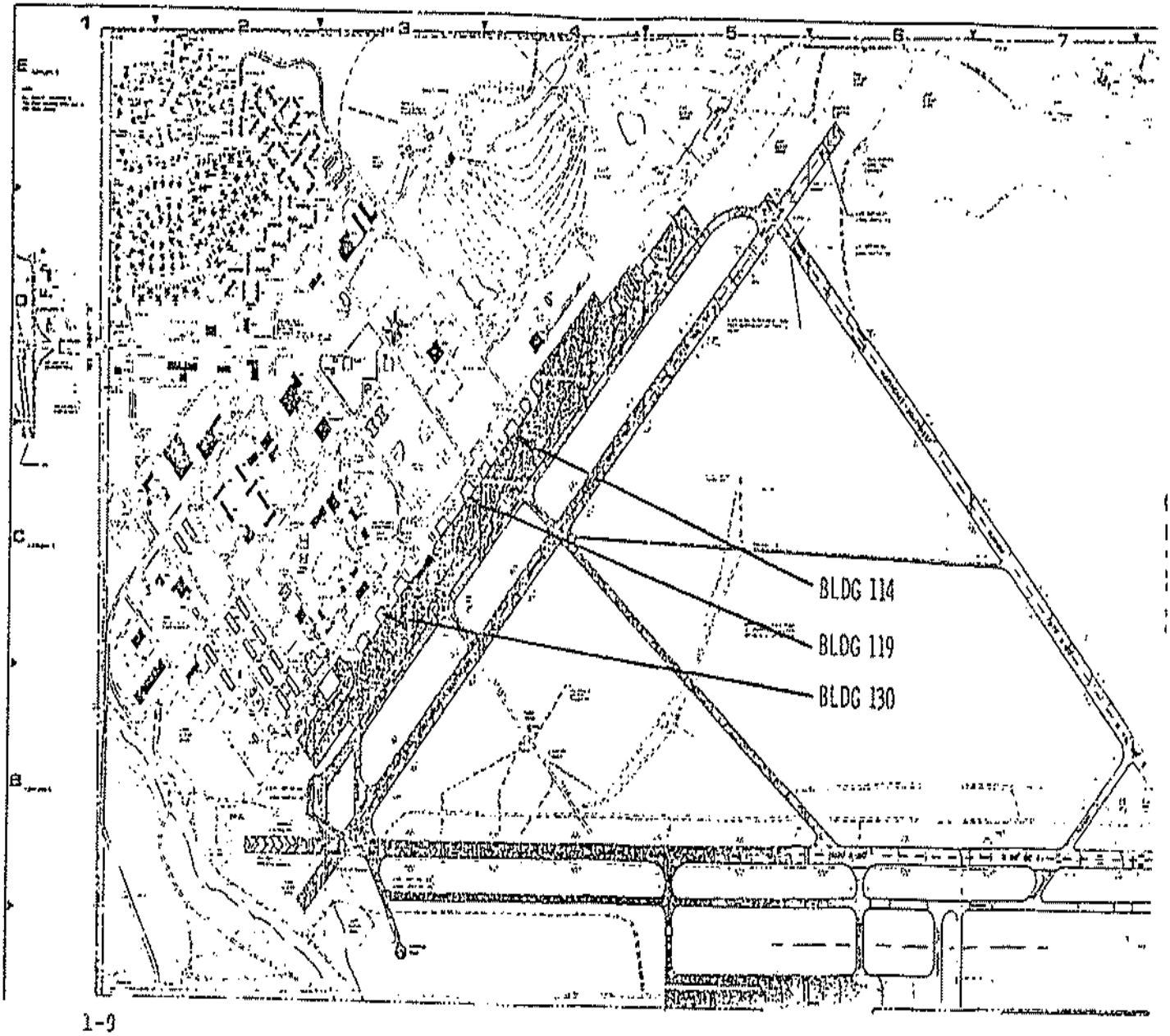


Figure 6. PETERSON AFB - AVAILABLE FACILITIES

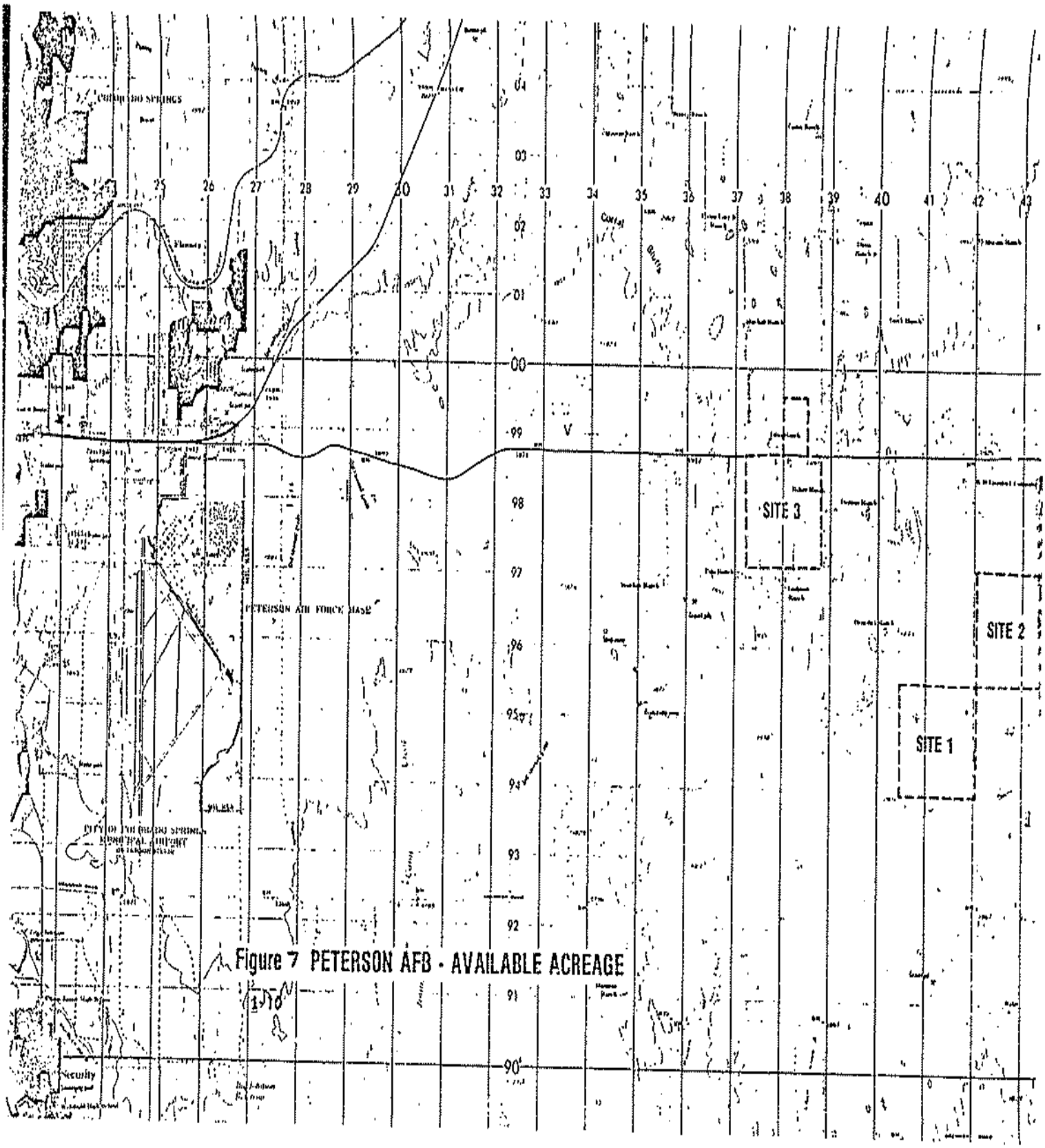


Figure 7 PETERSON AFB - AVAILABLE ACREAGE

and connects the base with downtown Colorado Springs, would serve as the primary access to all three proposed locations. All locations lie south of State Highway 94 and roads exist to each of the locations. Highway 94 is asphalt from the base to the turnoffs (6-8 miles) and the service roads are one to two miles of well maintained gravel roads to the sites. The CSOC facility layout is depicted in area 1 (preferred area) in Figure 8.

1.5 KIRTLAND AIR FORCE BASE, NEW MEXICO (Military Airlift Command). Kirtland AFB (Figure 9) is located in the County of Bernalillo, New Mexico, and is adjacent to the southeast boundary of the city of Albuquerque. Together, Albuquerque and the county represent the state's largest metropolitan area with a population of approximately 410,000. Albuquerque is served by two major interstate highways that cross in the city and the International Airport that handles an average of 1800 military aircraft sorties and over 12,000 commercial flights per month.

1.5.1 Kirtland AFB is bounded on the east by National Forest lands, on the south by the Isleta Indian Reservation, and on the north and west by the City of Albuquerque. The base contains 53,735 acres, of which 28,438 acres are owned by the Federal Government in fee and the remainder (25,297 acres) are public domain (forest land) The latter have been withdrawn from public use and are managed by the U.S. Air Force for a wide variety of military and federal government activities presently conducted at the base.

1.5.2 The host organization at Kirtland is the 1606th Air Base Wing (MAC). Major military and government units include the AF Contract Management Division (AFSC), AF Test and Evaluation Center, AF Weapons Laboratory (AFWL), New Mexico Air National Guard, 1550th Aircrew Training and Test Wing (MAC), Defense Nuclear Agency Field Command, Naval Weapons Evaluation Facility, USAF Hospital, Department of Energy (DOE) Albuquerque Operation Office, AFSC NCO Academy, AF Directorate of Nulcear Safety, 1960th Communication Squadron, and 3908th Aviation Depot Squadron. In addition, Kirtland AFB houses many on-base government contractors, including Sandia Corporation, Lovelace Biomedical and Environmental Research Institute, Boeing, General Dynamics, McDonnel-Douglas, Westinghouse and others. The military, government, and private tenants perform contract management, nuclear and laser research, development and testing, operational test and evaluation, advanced helicopter training, and HC-130 search and rescue training functions.

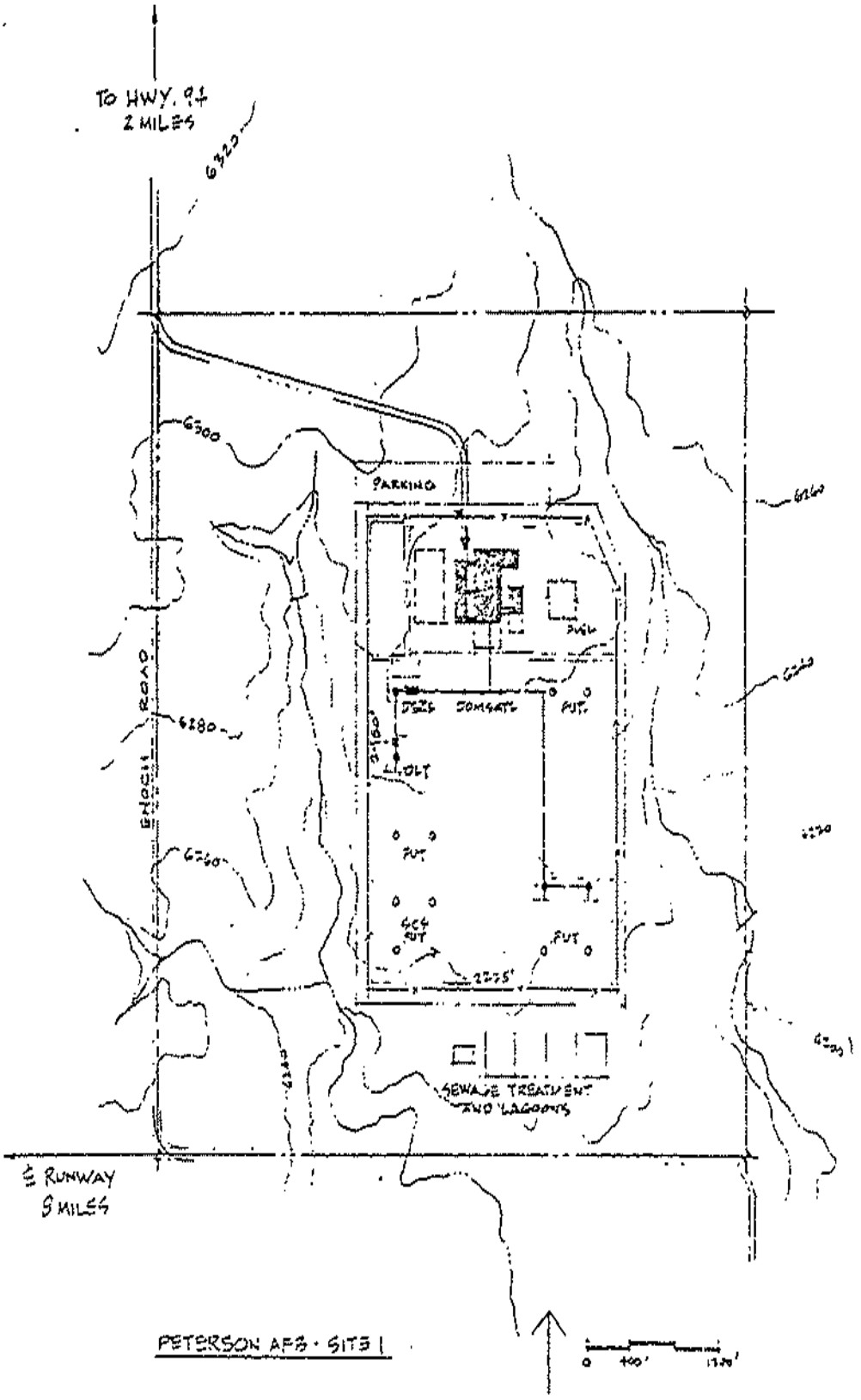


Figure 8. PETERSON AFB - CSOC FACILITY LAYOUT

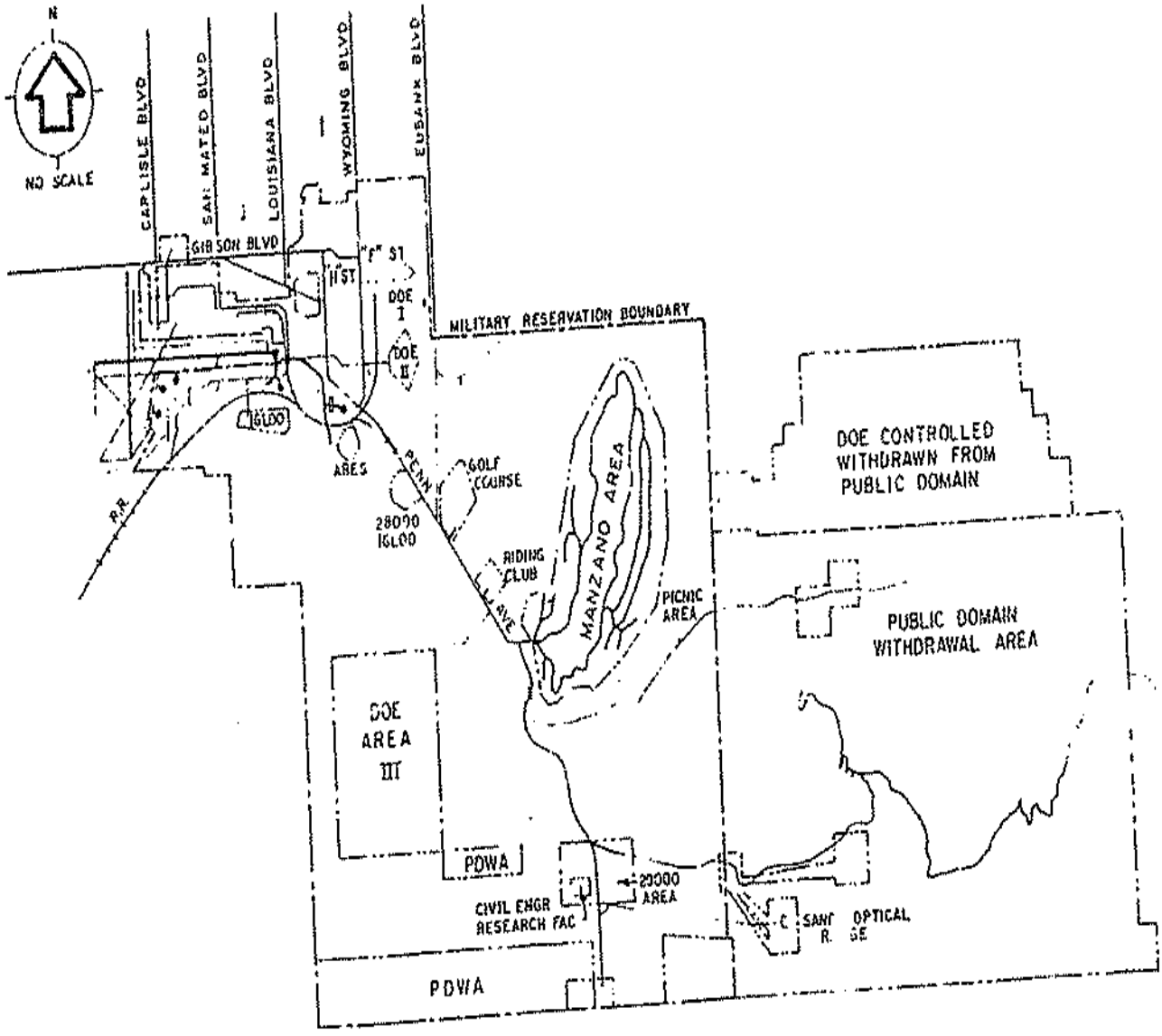


Figure 9. KIRTLAND AFB LAYOUT

Military Uses of Space: 1946-1991

Published by:
Chadwyck-Healey Inc., 1101 King Street, Alexandria, Virginia 22314

Military Uses of Space: 1946-1991 provides a detailed record of the strategic importance of the U.S. military space program from the conceptualization of the uses of space to the present realization of advanced capabilities. Materials were identified, obtained, assembled, and indexed by the National Security Archive, a non-profit, Washington, D.C. based research institute and library. The microfiche collection is accompanied by Military Uses of Space: 1946-1991 Guide and Index.

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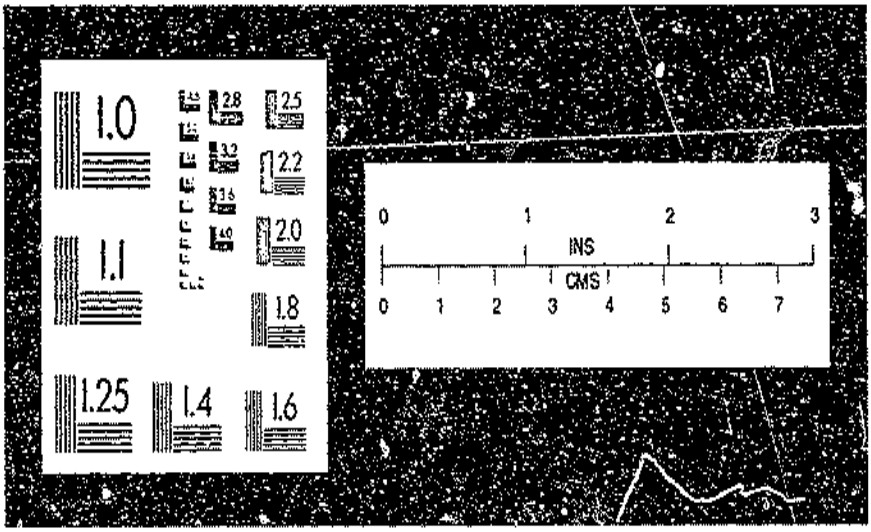

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Other activities on the base are the American Red Cross and three Albuquerque Public Schools.

1.5.3 Available Facilities: Facilities at both Kirtland Main and the Manzano area were offered for possible CSOC use. Three existing facilities are avalable on the main part of Kirtland (Figure 10). Two are Barracks (Bldgs 20360 and 20361) approximately 34,000 sq ft each, and an old laundry (Bldg 20451) with 18,000 sq ft. The Manzano facilities are located approximately 5 miles southeast from the primary Kirtland AFB area. The available Manzano complex consists of seven unused structures grouped on a hillside (Figure 11). All the buildings were built in the 1950's and a number of the buildings have been vacant since the early 1970's. Bldg 30143, the largest building in the complex (approximately 60,000 sq ft), is a four story masonry structure previously used as an administration building. This building is at the highest elevation of the available facilities. Down the hill are two barracks (Bldgs 30130 and 30132) with cement block exteriors and wood structure interiors. Each building is approximately 13,000 sq ft, divided between three floors. Additional buildings include a Mess Hall (Bldg 30133) with approximately 12,000 sq ft; a theatre (Bldg 30131) with approximately 3000 sq ft; a gymnasium (Bldg 30128) with approximately 12,000 sq ft; and a Chapel (Bldg 30129) with approximately 4000 sq ft. Additional structures include a swimming pool, tennis courts, and other buildings currently occupied by Manzano administration and security personnel.

1.5.3.1 CSOC Location: The Manzano area has the potential for maximizing the use of existing facilities and also best meets the other siting criteria. Because of the obscuration of the mountains immediately east of the Manzano area, an antenna site was proposed approximately two miles south of the Technical, Engineering and Administrative area (Figure 12). The full layout of all the CSOC facilities is depicted in Figure 12.

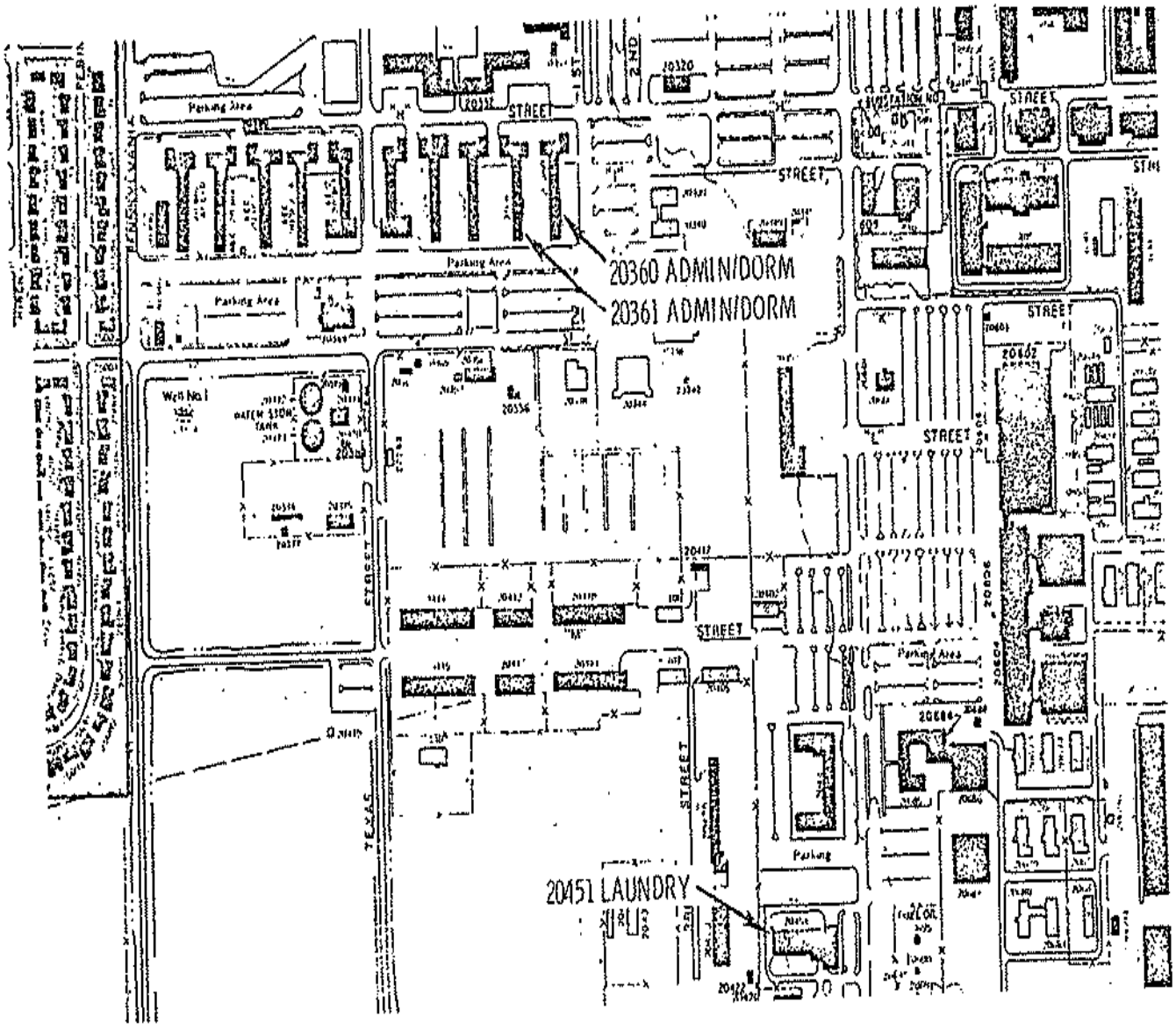


Figure 10. KIRTLAND AFB - AVAILABLE FACILITIES MAIN BASE

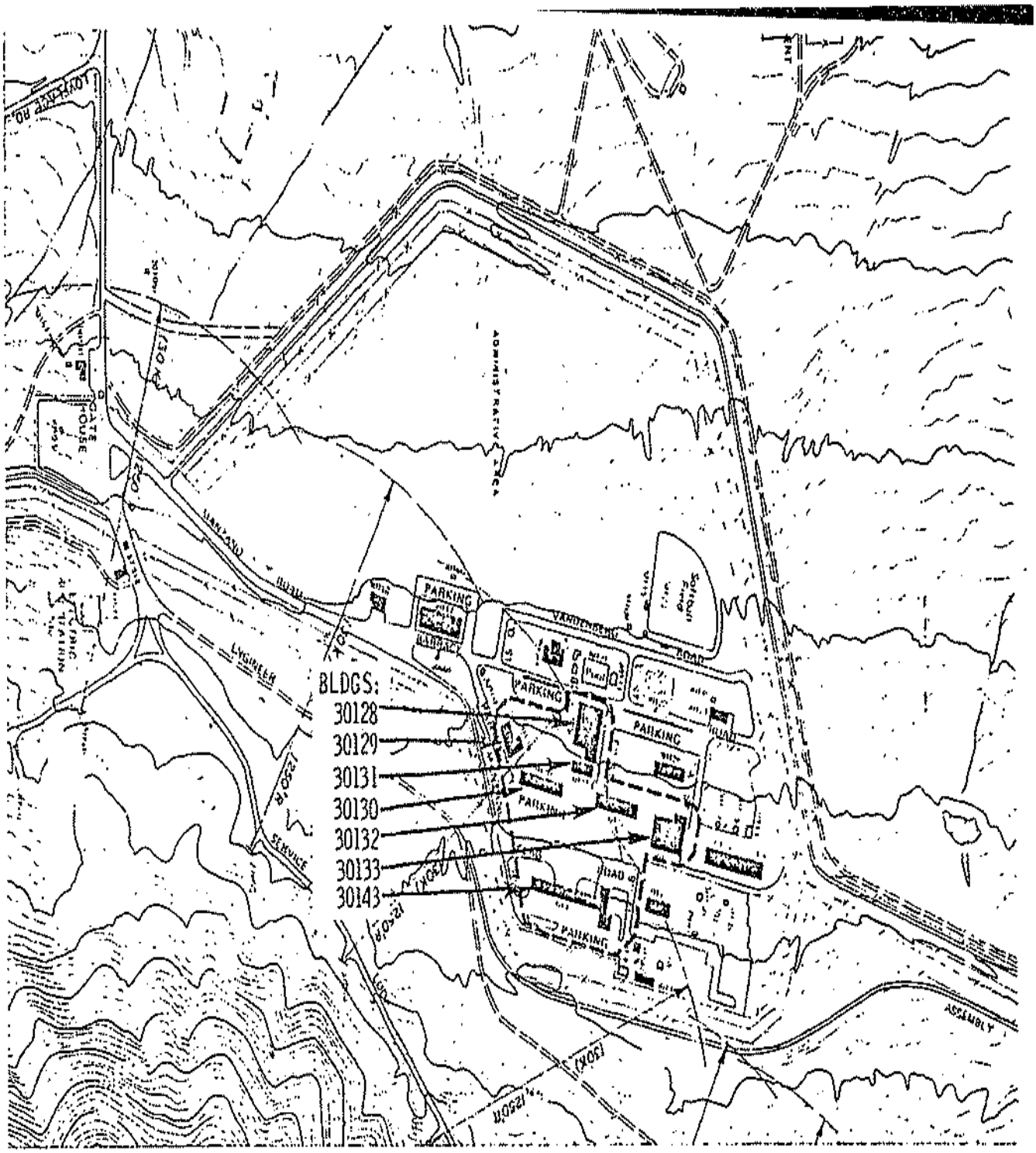


Figure11. KIRTLAND AFB - AVAILABLE FACILITIES MANZANO

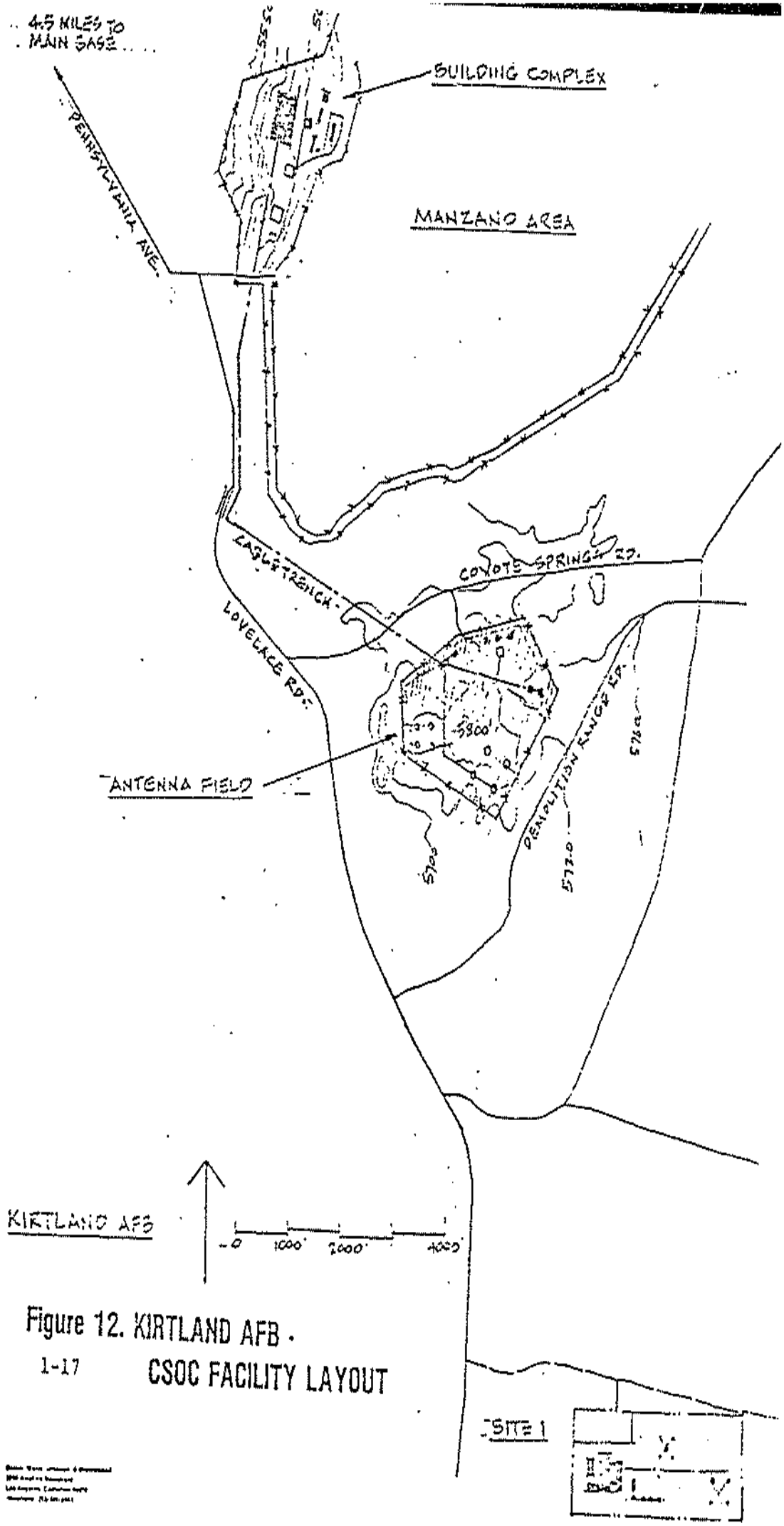


Figure 12. KIRTLAND AFB .

1-17 CSOC FACILITY LAYOUT

II
SITE EVALUATION

2.0 The three candidate sites were assessed against sixteen criteria. The following paragraphs identify the criteria and evaluate the sites against the criteria.

2.1 INTERIOR CONUS: Locate CSOC within the interior continental United States (CONUS), inland from coastal areas and international borders.

2.1.1 Rationale. The facility must be sited far enough inland from coastal waters and international boundaries to minimize potential interruption of space/ground communications. The distance from international borders also minimizes the impact of radio frequency (RF) interference in the international frequency range.

2.1.2 Impact if not satisfied.

-- A non-CONUS location would subject the mission to geopolitical influences.

-- Relaxation of the coastal and border distance constraints would present potential constraints to spacecraft communications.

-- Foreign nations would object to interference with their communications.

2.1.3 Assessment.

-- Malmstrom AFB, Peterson AFB and Kirtland AFB fully satisfy this criterion.

2.2 EMR HAZARD: Locate CSOC at least five miles from any runway used by military aircraft and at least 1000 feet from inhabited areas to preclude hazardous levels of electromagnetic radiation (EMR) from impinging on electroexplosive devices (EEDs) or on nearby personnel.

2.2.1 Rationale.

2.2.1.1 EED Hazards - AFR 127-100 provides specific guidance on allowable radiation power densities for EEDs installed within or being transported by aircraft. A power

density threshold of 10.0 mW/cm^2 has been specified for most installed and transported EEDs based upon an Aeronautical Systems Division (AFSC) analysis of aircraft sensitivity to radiation at frequencies from 1 to 40 GHz. Since the peak power radiation from a potential CSOC antenna system exceeds the 10 mw/cm^2 threshold, a restricted zone (within which a hazard is presented to aircraft) is required in the vicinity of the antenna. The aircraft traffic area at an active military runway extends for a five-mile radius around the center of the airport and up to 3,000 feet in height (Figure 13). A restricted zone cannot be established within this traffic area. As a result, the CSOC antenna field restricted zone must be located a minimum of five miles from an active military runway.

2.2.1.2 Personnel Hazards - OSHA provides a current standard Maximum Permissible Exposure Level (MPEL) for humans of $10mW/cm^2$ above 1 GHz. This standard is being reviewed by the scientific community, and a more stringent MPEL is expected to be adopted. When this expected standard of 1.0 mW/cm^2 is adopted, a buffer zone of 1000 feet from the antenna field is required to preclude future construction adjacent to the facility which might place the local population in a hazardous EMR area.

2.2.2 Impact if Not Satisfied. A requirement to operate CSOC antenna systems at lower power levels would jeopardize mission performance. Conversely, operating at the needed power levels may jeopardize human health, and/or local military flying operations if inadequate separation were provided between the facility and nearby inhabited areas and/or runways and traffic patterns.

2.2.3 Assessment.

2.2.3.1 Malmstrom AFB: Malmstrom AFB can not meet this criteria within the limits of available land. The antenna location represents no EMR hazard to aircraft or missile EED units under normal operating power levels; however, at planned power levels, future antenna systems may produce EED hazard zones above the south portions of the main runway. A limited access gate at the south end of the base also represents a potential hazard to missiles in transport due to its close proximity to the proposed CSOC antenna location. Work-arounds to both of these problems are available by restriction on aircraft/missile operations or, placing restrictions on the antenna systems (increasing antenna size could reduce ground level radiation potential), and CSOC peak power operations restrictions. However, if it is necessary to establish a restricted area around the

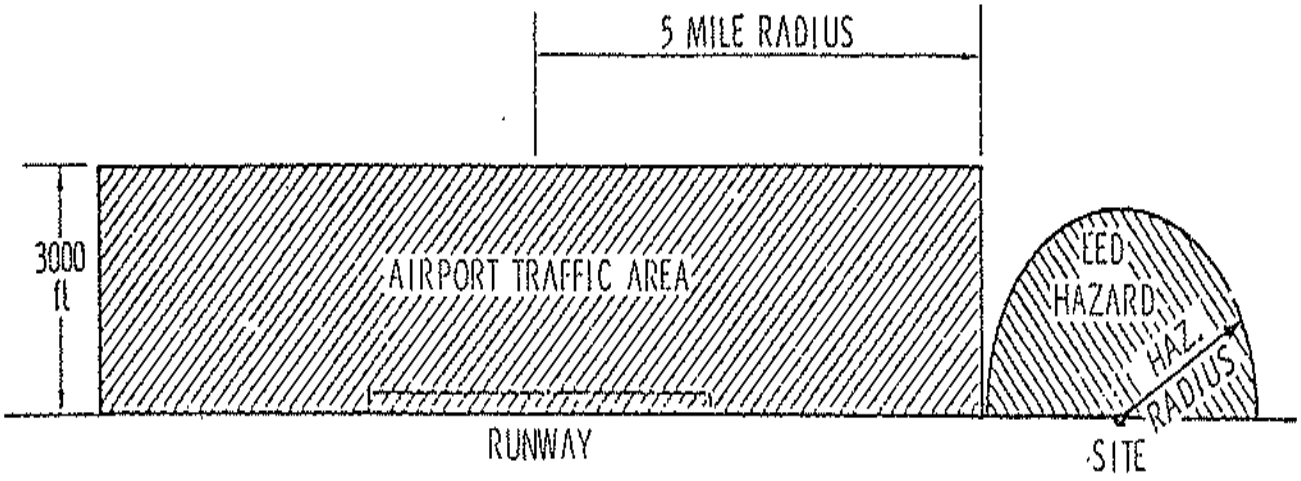


Figure 13. EED HAZARD ZONE

antenna field, it would require location of this restricted zone five miles from the nearest runway which would place the antenna field beyond the base perimeter and on private property. The Malmstrom AFB proposed antenna location does not conflict with the OSHA Maximum Permissible Exposure Level (MPEL) for personnel and, thus, does not represent a personnel hazard.

2.2.3.2 Peterson AFB: Peterson AFB meets the criteria. The proposed location on a 640 acre tract, approximately 8 miles east of any existing or planned runway, includes a 1000 foot buffer zone and presents no hazards to personnel.

2.2.3.3 Kirtland AFB: This base meets the criteria. The antenna field could be located at tract number two (Figure 12), directly south of the Manzano Area, on the top of a small ridge in an isolated section of the base. This location is greater than five (5) miles from the airfield and is not in conflict with air operations. The CSOC Technical E & A and Support buildings could be located at the Manzano Area which is approximately two (2) miles from the proposed CSOC antenna field. There would be no hazards presented to personnel or EEDs at this antenna location.

2.3 RF QUIET: Locate CSOC to avoid or minimize electromagnetic interference (EMI) in the L, S, X, K_u and K_a radio frequency (RF) bands.

2.3.1 Rationale. A minimum of electromagnetic interference in these bands is required to conduct satellite mission support. Also, there is a potential for CSOC antenna emissions to interfere with other nearby operations, such as maintenance and testing of sensitive electronic equipment.

2.3.2 Impact if Not Satisfied. Nearby sources of in-band EMI would interrupt or degrade the CSOC satellite mission support capability, and/or CSOC EMI would interrupt or degrade the mission of nearby systems operating at common frequencies.

2.3.3 Assessment.

2.3.3.1 Malmstrom AFB: No EMI problem exists at this location. No electronic systems operating at common frequencies were identified at Malmstrom AFB.

2.3.3.2 Peterson AFB: No current common frequency operations were discovered. There are approved plans to establish a communications satellite ground terminal in the vicinity of Peterson AFB with a planned operational date in 1983. This represents a potential interference source.

Careful control of specific channel assignments should permit adequate control over this potential interference problem.

2.3.3.3 Kirtland AFB. Kirtland AFB presents no RF interference problem. Although Kirtland is an extremely noisy RF area the following factors reduce this problem: Transmission sources are at a very low power level (typically 5 watts), and Kirtland offers a land area which permits a good degree of isolation of the proposed antenna field from existing RF activities.

2.3.3.3.1 Several activities at Kirtland AFB were investigated for potential interference affecting CSOC antenna systems. These activities included the Air Force Weapons Laboratory's (AFWL) Vertical and Horizontal Polarized Dipole (VPD) antenna and TRESTLE facilities utilized for EMP experimentation, Sandia Corporation's Electron Beam Fusion Facility (EBFF) operated for the Department of Energy (DOE), and the AFWL Sandia Optical Test Facility used for laser experimentation. The first three installations are operated intermittently at various times during the day when a single high energy pulse is emitted during each operation. Radiation levels are maintained below the current Air Force Surgeon General standard of 100,000 volts/meter. Discussions with AFWL personnel and information received concerning Sandia Corporation operations resulted in mutual agreement that no direct in-band frequency EMI/RFI problem would exist. In addition, an investigation of the corona discharge effects at the EBFF revealed that RF radiation at CSOC operating frequencies are significantly attenuated by the six miles distance to the proposed antenna location. However, a survey by ECAC should be performed prior to actual facility buildup.

2.4 OBSCURA: Locate CSOC such that the elevation angle of the maximum obstruction is less than 5 degrees.

2.4.1. Rationale. The CSOC will use communications satellites in both synchronous and Molniya orbits. Mission loading and operational timelines necessitate communication satellite contacts at elevation angles down to 5 degrees. These contacts are particularly important when they are used to support a malfunctioning satellite.

2.4.2 Impact if Not Satisfied. Local obscura would degrade the ability of the CSOC to carry out its support mission by reducing satellite visibility during low elevation passes.

2.4.3 Assessment.

2.4.3.1 Malmstrom AFB: Malmstrom AFB meets this criteria. The maximum obscura does not exceed 1.5 degrees in all quadrants.

2.4.3.2 Peterson AFB: The site east of Peterson AFB meets this criteria. The highest obscura due west is less than 5 degrees.

2.4.3.3 Kirtland AFB: The antenna location at Kirtland AFB does not meet this criteria for the entire 360 degree horizon. Terrain obstructions over a small segment of the horizon exceed the 5 degree minimum elevation angle obscura criterion for a CSOC antenna system. Also obscura data shows that Sandia and Manzano Mountains present viewing conditions that violate the five degree minimum elevation angle by up to one degree for a planned CSOC antenna system. Possible work-arounds include relocating the antenna field further to the southwest (placing it in proximity to other existing test facilities), and/or elevating the antenna system on a pedestal and/or constraining satellite operations above 5 degree elevation angle.

2.5 NATURAL DISASTER: Locate CSOC in an area with minimum potential for natural disasters.

2.5.1 Rationale. A principal justification for the CSOC program is the vulnerability of the existing Satellite Test Center (STC) and Johnson Space Center (JSC) facilities to natural disasters. Locating the facility in an area prone to earthquakes or other natural disasters (such as floods, tornados, or hurricanes) completely negates the objective of reduced vulnerability to perform satellite and shuttle operations.

2.5.2 Impact if not Satisfied. A natural disaster has the potential of causing loss of mission support and loss of the high dollar investment in the facility and the space systems supported by the facility. Loss of these space systems will seriously impact national security.

2.5.3 Assessment.

2.5.3.1 Malmstrom AFB, Peterson AFB, and Kirtland AFB all satisfy this criterion. These sites are not prone to earthquakes, floods, tornados, or other crippling natural disasters.

2.6 ACREAGE: Provide CSOC a site of at least 107 acres, plus a 1000 foot EMR hazard buffer zone.

2.6.1 Rationale. The area incorporating the facility must be large enough to accommodate all structures and to provide sufficient separation (150-200 feet) among antenna systems and buildings to minimize electromagnetic interference. The 1000 foot buffer zone around the CSOC facility isolates the local population from potential EMR hazards and increases facility security.

2.6.2 Impact if Not Satisfied. A site smaller than 107 acres would result in increased antenna interference and possible mission degradation. Lack of a 1000 foot buffer zone would increase the EMR hazard risk to the local population and increase the susceptibility of the facility to physical (man-made) threats.

2.6.3.1 Malmstrom AFB: Malmstrom meets this criteria. Option A places the technical and support buildings in the central area of the main base. Based on anticipated demolition/relocation of various semi-permanent structures west of the SAGE site, the area is adequate for the baseline facility. Option B uses a vacant 135 acre plot of federal land on the south side of the base and includes adequate area for the technical facility, antenna field, and a 62,500 sq ft E&A facility.

2.6.3.2 Peterson AFB: Peterson does not meet this criterion unless additional land is acquired. Approximately 640 acres of non-federal property 10 miles east of the base does meet this criterion, with ample room for expansion of Technical, E&A, and antenna field.

2.6.3.3 Kirtland AFB: Kirtland meets this criterion. The location within the Manzano area has ample room for expansion. Additionally, Kirtland AFB has many potential locations for additional antennas and facilities.

2.7 MILITARY BASE: Locate CSOC on or within 50 miles of an active military installation because of the number of support services required.

2.7.1 Rationale. An active military installation provides significant support for both military personnel and dependents, such as medical, commissary, exchange, religious, and morale, welfare, and recreation (MWR) services. Base support services such as civil engineering, warehousing, fire protection, personnel, motor pool, security police, dining halls, training, and dormitories are

also required, and a large base could provide many of these services. Fifty miles is considered the maximum distance at which any significant support could be rendered.

2.7.2 Impact if Not Satisfied. A major cost impact would result from a remote location because of the need to provide minimum support facilities and services for military (and dependent) personnel. While some incremental costs will certainly be incurred even with CSOC on or near a large base, it is estimated that the penalty of a remote location in support costs alone, exclusive of family housing, would be on the order of $10 million. Increased operational costs would also result due to (1) increased manpower requirements to operate additional support facilities, and (2) operations and maintenance costs of the support facilities themselves.

2.7.3 Assessment. This section provides an assessment of the candidate sites with respect to support available from the host base and the impact of CSOC on that support. Support is addressed in the following areas:

- Administrative Services
- Comptroller
- Judge Advocate/Chaplain
- Consolidated Base Pers Ofc
- Consolidated Civ Pers Ofc
- Security & Law Enforcement
- Medical facilities
- Commissary/BX
- Messing -
- Structural Fire Fighting
- Services
  Maintenance (PMEL)
- Transportation Svcs
- LOGAIR
- Housing
- Morale, Welfare & Rec
- Education Services
- Communication Support

2.7.3.1 Administrative Services. These services include printing and reproduction services, distribution/publication and forms services, procurement and contracting support, mail and message services.

2.7.3.1.1 Malmstrom AFB. All services can be provided to CSOC without adverse impact. Contracting support can provide common-type requirements involving supplies and services with present resources. If unusual or urgent situations develop, there may be an impact on the manning and grade structure of this function.

2.7.3.1.2 Peterson AFB. ADCOM realignment will reduce support demands on Peterson and allow Admin Services to channel support to CSOC. For example, distribution services for publications and forms and mail and message services currently serve the Chidlaw Building (HQ ADCOM) which is six miles from Peterson. After ADCOM realignment - NORAD moves to Peterson - the services will be able to use existing

vehicles and other resources to support a remote CSOC site, 6-10 miles from Peterson. The procurement and contracting function will expand - the addition of a technical section. In addition, the function currently manages procurement for large space systems and contractual arrangements with aerospace firms. The Peterson AFB Procurement Office is well staffed and has the background to provide a wide spectrum of procurement and contractural support of CSOC. All Administrative Services can provide support without manpower or facility expansion.

2.7.3.1 Kirtland AFB. The base reproduction/duplication center has limited printing services. The center is limited to 25,000 units (1 page = 1 unit) for any one job. For example, printing of a 100-page (unit) document would be limited to 250 copies of the document. The Defense Nuclear Agency's Field Command Printing Plant, located on Kirtland AFB, has exceptional capability to provide printing and duplication services. However, an interservice support agreement would have to be negotiated to obtain these services for CSOC. Publications and forms distribution can be provided with an anticipated impact on manpower but no impact on facilities. Mail and message service to the Manzano area is currently three days a week, once a day. The CSOC requirement (anticipate five days a week, twice daily) would impact on manpower and vehicles, but no impact on facilities. Procurement, i.e., local purchase to support CSOC, would impact both manpower and facilities. Contracting support for local services can be provided without impact on manpower or facilities. The base procurement/contracting function is subordinate to Air Force Systems Command and not to the host, Military Airlift Command. The procurement/contracting office has an R&D contracting section in addition to other services.

2.7.3.2 Comptroller. The capability of providing accounting and financial operations support.

2.7.3.2.1 Malmstrom AFB. The Comptroller could support normal financial requirements of CSOC. Unusual accounting, disbursing or budgeting requirements could not be met without additional manpower.

2.7.3.2.2 Peterson AFB. CSOC would have impact on manpower in some areas. Military Pay - currently paying 5900; could absorb CSOC accounts without difficulty. Civilian pay - currently paying 1400 accounts; would require additional technicians with each increment of 200-250 accounts. Travel Section - currently paying 1200-1500 vouchers per month. Additional vouchers could be absorbed

with increased manning. Commercial Services - presently accounting for large contracts; could absorb additional contracts without impact. In all cases - no impact on facilities.

2.7.3.2.3 Kirtland AFB. CSOC would impact on manpower in some areas. Military Pay - currently paying 4,100; impact of CSOC on manpower but not facilities. Civilian pay - currently paying 3,000; no impact on manpower or facilities. Travel Section - currently paying 2,000 - 2,500 voucher per month. CSOC would impact on manpower but not on facilities. Commercial Services - CSOC would impact on manpower but not on facilities.

2.7.3.3 Judge Advocate/Chaplain.

2.7.3.3.1 Malmstrom AFB. With current authorizations, legal and chaplain services can be provided without adverse impact.

2.7.3.3.2 Peterson AFB. No impact generated by CSOC. JAG office is forecasted to expand manpower due to addition of technical office to base procurement. Site would have no impact on manpower or facilities. Chaplain services can also be provided without facility or manpower impact.

2.7.3.3.3 Kirtland AFB. CSOC would impact JAG claim section manpower. No contractual service is provided. Other legal services can be provided without impact. Chaplain services can be provided without impact.

2.7.3.4 Consolidated Base Personnel Office (CBPO). Capability for providing testing, separation, retirement, release from active duty, re-enlistment processing, classification and administrative board support.

2.7.3.4.1 Malmstrom AFB. The CBPO should be able to adequately support CSOC. The CBPO presently serves 5072 active duty personnel. A total of 892 active duty will depart the base (disestablishment of 17th DSES and of 24th NORAD Region SAGE) prior to influx of 304 active duty to support CSOC. Forecasted CBPO authorizatin losses are two.

2.7.3.4.2 Peterson AFB. The CBPO can provide service to CSOC military personnel without additional impact to manpower or facilities. The CBPO presently services 6,030 active military. Projected CBPO personnel losses are 13 slots as a result of ADCOM realignment, however, the number of active military requiring personnel support is projected to decline to 5,012, also as a result of realignment.

2.7.3.4.3 Kirtland AFB. Support of CSOC can be provided without impact. The CBPO presently serves 4,100 personnel. A gain of five authorizations has been approved for CBPO.

2.7.3.5 Consolidated Civilian Personnel Office (CCPO.

2.7.3.5.1 Malmstrom AFB. Based upon current manpower authorizations, the CCPO should be able to adequately support the 110 DAF civilians associated with CSOC. The CCPO presently serves 603 civilians. Fifty-five civilians will depart as of 30 Sep 79. Another 36 civilians will depart upon disestablishment of the SAGE operation. The CCPO has no manpower losses projected at this time.

2.7.3.5.2 Peterson AFB. CSOC can be adequately supported. Number of civilian personnel currently served - 1,822. Projected personnel losses after ADCOM realignment - five. Projected number of civilian personnel to be served after realignment - 1,601.

2.7.3.5.3 Kirtland AFB. Currently serves 3,000 - no impact on CCPO for service to CSOC.

2.7.3.6 Security and Law Enforcement.

2.7.3.6.1 Malmstrom AFB. Security police function can adequately support CSOC. The local security mission is supported by over 1,000 security police with base responsibilities and responsibilities in a 24,000 sq mi area surrounding the base. Security Response Teams (three two-member alarm response team and a ten-member reserve force) are available for protection of priority A resources and for timely response to on-base situations. The Security Police also patrol and control access to the SAGE building, a priority A resource. With current manpower authorizations and with the disestablishment of the SAGE operation, the Security Police could provide similar support to CSOC.

2.7.3.6.2 Peterson AFB. CSOC would impact resources of security police. The 46th Aerospace Defense Wing Security Police have a strength of approximately 80 personnel most of whom are assigned to the law enforcement career field (811X2). They are responsible for law enforcement at Peterson AFB and can provide contingency support to the Cheyenne Mountain Complex. If CSOC were designated a priority A resource, additional security specialists (811X0 career field) and police vehicles would be needed to provide 24 hour Security Response Team protection.

2.7.3.6.3 Kirtland AFB. CSOC would impact security police resources. The 1606th Security Police Group has a strength of approximately 600 people, including 389 security specialist (811X0 career field). These personnel presently patrol restricted areas near the Manzano complex and could be used to patrol CSOC if CSOC were located in the Manzano area. However, additional personnel and police vehicles would be required. Also, if CSOC were located in the Manzano area, traffic on Pennsylvania Avenue, the main road to the CSOC location, would periodically be prohibited for up to 30 minutes, when weapons are being transported.

2.7.3.7 Medical Facilities. Hospital and Dental.

2.7.3.7.1 Malmstrom AFB. Speciality care is limited. The USAF hospital at Malmstrom AFB is a 10-bed acute care facility currently serving approximately 5,200 active duty members and their dependents plus approximately an additional 2,300 retirees. The hospital can expand to a 25-bed facility. Specialized care, not locally available, is provided through CHAMPUS or aeromedical evacuation to Madigan Army Medical Center, Tacoma, WA; and to Fitzsimmons Army Medical Center, Denver, CO. The dental facility has 15 treatment rooms, ten of which are currently being used for patient care. Except for specialized care, which can be arranged, medical facilities at Malmstrom AFB should be able to adequately support authorized CSOC personnel.

2.7.3.7.2 Peterson AFB. Both medical and dental facilities can fully support CSOC and/or arrange for specialist service as required. Peterson AFB has a modern, well equipped outpatient medical clinic. Additional medical services, including up to 889 total beds, are available within 50 miles at the USAF Academy, Fort Carson, and Fitzsimmons Army Medical Center Hospitals. Care requiring specialists is available through CHAMPUS. Specialized care, not locally available is provided through CHAMPUS or aeromedical evacuation to the USAF Regional Hospital at Sheppard AFB, Texas, or elsewhere as required. The dental facility has 23 treatment rooms, 12 of which are currently being used for patient care. The Peterson AFB medical and dental operations have no difficulty in obtaining qualified personnel to staff their authorized positions.

2.7.3.7.3 Kirtland AFB. Kirtland AFB has an older, but well equipped hospital, offering a full spectrum of medical services. The Kirtland Hospital presently maintains 30 beds, but could expand to over 65 beds if required. Specialized care, not locally available, is provided through CHAMPUS or aeromedical evacuation to William Beaumont Army Medical Center, El Paso, Texas or to Wilford Hall Medical Center, San Antonio, Texas. The dental facility has 19

treatment rooms, approximately 11 of which are currently being used for patient care. Both the medical and dental operations can fully support authorized CSOC personnel with existing resources.

2.7.3.8 Commissary/BX

2.7.3.8.1 Malmstrom AFB. The Commissary can provide adequate service; it is well stocked and organized. Commissary warehouses are also well stocked - sufficient supplies on hand to feed the present base population for approximately 15 days. Construction to expand warehouse space will be completed in CY 79. A service construction project ($1.8M) to remodel the main exchange is presently underway. The exchange is adequate to support authorized CSOC personnel.

2.7.3.8.2 Peterson AFB. Both the Commissary and Base Exchange can easily support the anticipated base population if a CSOC were located at Peterson AFB or vicinity. Peterson AFB has a large and modern Commissary stocking an average of 9,800 line items. There are 15 check stands. Average daily customer count is 2,336. The Base Exchange is large, modern, and well stocked.

2.7.3.8.3 Kirtland AFB. Both the Commissary and Base Exchange can easily support the anticipated base population if CSOC were located at Kirtland AFB. Kirtland AFB has a large and well organized Commissary stocking over 6,000 line items. There are 18 check stands. Average daily customer count is 2,363. The main Base Exchange, located at Kirtland East, is a new and well stocked facility. A new Four Seasons store containing clothing sales, outdoor goods, flower shops and concessions will soon be opened in renovated Bldg 20224 at Kirtland East. Kirtland West also has a BX annex carrying stop and shop food items and toys.

2.7.3.9 Messing.

2.7.3.9.1 Malmstrom AFB. The base can meet messing requirements for Option A only. The base has one centrally located enlisted dining facility with a seating capacity of 348, expandable to 1044, located within walking distance of the proposed location, Option A. The facility is more than adequate to serve CSOC military. The base exchange cafeteria is currently being remodeled and will be capable of serving 1,000 meals per day. This facility is also within walking distance from the proposed CSOC location, Option A. Officers and NCO Club facilities serve three meals per day with exception of limited weekend services. A collocated CSOC dining facility is planned if CSOC is located away from the main base, Option B.

2.7.3.9.2 Peterson AFB. The base cannot meet all messing requirements. The base has a modern centrally located enlisted dining facility with a seating capacity of 380, expandable to 400. The Base Exchange cafeteria can seat up to 84 people and serves and average 400 meals per day, including take out service. The Officers and NCO clubs serve three meals per day with the exception of limited weekend services. All base eating facilities can easily support anticipated CSOC personnel residing on base. A collocated CSOC dining facility is planned.

2.7.3.9.3 Kirtland AFB. With facility renovations, messing requirements could be met. The base has two active dining facilities serving three meals per day. The Kirtland East dining facility normally seats 246 people, but could be expanded to 738. The Kirtland West dining facility also serves a midnight meal, seats 258 people, and could be expanded to 774. If CSOC were located in the Manzano area, there is a possibility that the "pickled" (closed) Manzano dining facility could be renovated and converted to a messing facility. The BX cafeteria is located on Kirtland East, serves breakfast and lunch and seats 85 people. The Officers' Club serves three meals daily and the NCO club serves lunch and dinner daily.

2.7.3.10 Structural Fire Fighting Services.

2.7.3.10.1 Malmstrom AFB. The Fire Protection is adequate for CSOC facilities. The Fire Station, Building 349, is an eight vehicle stall station. There are 10 firefighting (three structural) and three general purpose vehicles assigned. The Fire Protection Branch Operations Section and the Alarm/Communications Center are manned on a 24 hour a day basis.

2.7.3.10.2 Peterson AFB. An additional station to house a structural fire protection vehicle may have to be constructed adjacent to the site. The single fire station is an eight vehicle stall station. There are 10 firefighting (3 structural) and three general purpose vehicles. The Operations Section and the Alarm/Communications Center are manned on a 24 hour a day basis. However, fire protection for the proposed CSOC site may not be adequate due to distance from the station (5-10 miles). AFR 92-1 states the desirable distance/response time from a station to a operational/tehnical facility be 1-2 miles/4-5 minutes.

2.7.3.10.3 Kirtland AFB. CSOC would have no impact on manpower or facilities. There are five fire stations at Kirtland, one located in the Manzano complex. The Manzano station has two stalls, and two vehicles (both

structural). The station is adjacent to the proposed CSOC location. The Alarm/Operations Center is manned on a 24 hour a day basis.

2.7.3.11 Maintenance (PMEL).

2.7.3.11.1 Malmstrom AFB. With present manpower authorizations, Base PMEL should be able to support anticipated CSOC PMEL requirements using existing facilities and Traveling Field Calibration Units, visiting CSOC every 90 days, approximately ten days duration.

2.7.3.11.2 Peterson AFB. CSOC may impact manpower. Base PMEL is presently authorized 13 personnel. To support anticipated CSOC PMEL requirments, additional people (qualified/skilled at the seven level or above), may be required above authorized strength. No additional space is required, since most items will be serviced annually by a Traveling Field Calibration Unit visiting every 90 days, approximately ten days duration.

2.7.3.11.3 Kirtland AFB. To support anticipated CSOC PMEL requirements, additional people will be required. Base PMEL is presently authorized and assigned 60 people. The Base PMEL has no Traveling Field Calibration Unit, but maintains extremely accurate class 2C (research, test and development) calibration standards and equipment. Turnaround time is usually five days or less. Base PMEL is presently planning to expand their facilities to satisfy laser, optical, and other equipment requirements. Depending upon the exact CSOC items to be serviced, base PMEL may be able to provide field calibration support for those items that can not be readily transported.

2.7.3.12 Transportation Services.

2.7.3.12.1 Malmstrom AFB. The base motor pool will be able to maintain the anticipated 15 vehicles assigned to CSOC with existing motor pool facilities, but an increase in the numbers of mechanics may be required.

2.7.3.12.2 Peterson AFB. The base motor pool will be able to service and maintain the anticipated 15 vehicles assigned to CSOC with existing motor pool facilities, but an increase in manpower is anticipated.

2.7.3.12.3 Kirtland AFB. Transportation is presently undergoing a study to increase the number of authorized mechanics. If the increase is approved, CSOC will not impact manpower. In both cases (approval or disapproval), CSOC does not impact facilities.

2.7.3.13 LOGAIR: Malmstrom AFB and Kirtland have daily service by LOGAIR, Peterson has five day a week service.

2.7.3.14 Housing. Includes family, bachelor, and transient quarters.

2.7.3.14.1 Family Housing.

2.7.3.14.1.1 Malmstrom AFB.

	Officer	NCO (E-4 over 2 and above)
Available	314	1,092
Occupancy	99%	96%

(Approximately 100 officer units and 260 NCO units will be vacated with disestablishment of 17th DSES and SAGE Center)
Waiting Period: None
Mobile Homes - Government Owned
(E-4 under 2 and Airmen)
No of Units 112
Occupancy 40%
House and Trailers are in satisfactory condition.

2.7.3.14.1.2 Peterson AFB.

	Officer	NCO
Available Units	106	384
Occupancy	99%	99%

Average Waiting Period 2-6 months
Peterson AFB has excellent, modern and attractive family housing. In addition, approximately 200 families reside in Government quarters at the Air Force Academy, approximately 20 miles distant.
Mobile Home Park
No of spaces 37
Occupancy 90%

Peterson AFB maintains no Government mobile homes, but provides space for private units

.2.7.3.14.1.3 Kirtland AFB.

	Officer	NCO
Available Units	300	1834
Occupancy	92%	97%
Waiting Period	None	1 month or less

Kirtland AFB has a variety of family housing units constructed in the 1950's and early 1960's. All units are considered adequate. Over the last two years, approximately $3 million has been spent to refurbish NCO housing. Other significant housing impro ements have included exterior painting, reroofing, energy conservation measures and street paving.

Mobile Homes

Kirtland AFB has no Government mobile homes or mobile home parks.

2.7.3.14.2 Bachelor Housing.

2.7.3.14.2.1 Malmstrom AFB.

BOQ Spaces	
Available	68
Occupancy	82%
Dormitories (Enlisted):	
No of Units	1666
Occupancy	89%

2.7.3.14.2.2 (U) Peterson AFB.

BOQ Spaces:	
Available	40
Occupancy	100%

The Peterson AFB BOQ is a modern, attractive, new building. Unlike BOQs elsewhere, Peterson AFB maintains a waiting list to live in the BOQ.

Dormitories (Enlisted):	
No of Units - Male	656
No of Units - Female	120
Occupancy	95%

2.7.3.14.2.3 Kirtland AFB.

BOQ Spaces:	
Available	48
Occupancy	100%
Dormitories (Enlisted)	
No of Units - Male	1668
Occupancy	48%
No of Units - Female	150
Occupancy	74%
Manzano units closed-"pickled"	259

Kirtland AFB has recently renovated all permanent party housing units, except one building which remains to be completed.

2.8.3.14.3 Transient Housing:

2.7.3.14.3.1 Malmstrom AFB.

VOQ - 45 rooms - 95% occupancy
VAQ - 12 rooms (24 spaces) - 95% occupancy
TLQ - 40 rooms - 69% occupancy

2.7.3.14.3.2 Peterson AFB.

VOQ - 40 rooms - 84% occupancy
VAQ - 85 rooms - 65% occupancy
TLQ - 40 rooms - 85% occupancy

The above transient quarters are new and in excellent condition. In addition to the above transient quarters, the billeting office maintains contract quarters with seven motels, as required.

2.7.3.14.3.3 Kirtland AFB.

VOQ - 211 rooms - 70% occupancy
VAQ - 169 rooms - 64% occupancy
*TLF - 58 rooms - 60% occupancy
*Temporary lodging facilities - guest cottages.

2.7.3.15 Morale, Welfare, and Recreation.

2.7.3.15.1 Malmstrom AFB. Facilities include youth center, arts and crafts center, gymnasium, wood craft/auto craft shop, bowling center, library, child care center, recreation center, family camp, motocross track, indoor swimming pool, various athletic fields (tennis courts, etc), saddle club, flying club and ski club.

2.7.3.15.2 Peterson AFB. The MWR facilities are exceptional; most facilities have been constructed or improved in the past three years. Facilities include Recreation Supply (Extensive outdoor equipment: skiing, camping, boating, trailers, etc.), bowling alley, child care center, golf course, youth center (with gymnasium independent of base gym), base gym, hobby shop (ceramics, auto, wood, electronics, photo, lapidary), indoor and outdoor tennis courts, various other athletic fields, recreation center, rod & gun club (skeet and trap shooting range), swimming pool, aero club, and picnic areas.

2.7.3.15.3 Kirtland AFB. Many MWR facilities are duplicated at Kirtland, as a result of absorption of Sandia Army Post in 1971. MWR facilities include two gymnasiums, two bowling centers, two libraries, two auto hobby shops, two child care centers, two arts and crafts centers, an indoor swimming pool (olympic size), athletic fields, tennis courts, golf course, riding stable, picnic areas, and an aero club.

2.7.3.16 Education Services:

2.7.3.16.1 Malmstrom AFB. An education center is presently under construction ($1,400,000). The center will

offer a very wide spectrum of education programs for which military and civilians (including non-DAF) will be eligible. The programs include Associate Degrees (Arts and Sciences and Technical/Occupational programs), Baccalaureate Degrees (Arts and Sciences, Business, Industrial Technology programs), Masters Degrees (Business, Systems Management, Human Resources programs), and Doctoral Degrees (Adult and Higher Education). In addition, Professional Military Education Seminars and Group Studies are also offered.

2.7.3.16.2 Peterson AFB. Six universities offer undergraduate, masters and doctorial programs on base. Of the six, three allow participation by active duty, DAF civilians and their dependents - non DAF civilians may not participate. Undergraduate disciplines include business and arts and sciences. Masters programs include business and arts and sciences. The two doctorial programs are higher education and education counseling. No vocational or occupational courses are offered on base. Professional Military Education includes PME 1 and 2 (enlisted) and Air War College and Air Command and Staff College Seminars. Squadron Officer School study groups are also sponsored.

2.7.3.16.3 Kirtland AFB. Five universities offer degree programs on base. All programs are open to military, DAF civilians, and non-DAF civilians. Degrees include B.A. (Liberal Arts), B.S. (Occupational Education and Electronic Technology), Masters of International Affairs (five geographical areas), and an MBA. No doctoral programs are offered. No vocational/occupational programs are offered. Professional Military Education 1 and 2 (enlisted) and Air Command and Staff College Seminars are sponsored by the education office.

2.7.3.17 Communications Support. Three aspects of base communications support were addressed during the survey.

(1) Commercial long-line interface capability.

(2) The ability of the local commercial telephone company (or government equivalent) to support CSOC telephone requirements.

(3) Base Telecommunications services available to support CSOC.

2.7.3.17.1 Commercial Long-Line Interfaces. An estimated 200 commercial circuits (including AUTOVON, local, commercial foreign exchange tie lines, teletype and data circuits, and dedicated voice circuits) are required to support CSOC.

2.7.3.17.1.1 Malmstrom AFB. The base has excellent interconnectivity and alternate routing capability into the commercial long-line system. Three routes exist from the site to the Great Falls Commercial Exchange, which in turn has four different routes for circuit routings - adequate support for CSOC.

2.7.3.17.1.2 Peterson AFB. The base has direct interconnectivity with the Cheyenne Mountain Complex and the commercial long-line system. The exchange and cable systems on base are leased and maintained by Mountain Bell Telephone Company. Expansion of the system would be required for the proposed project.

2.7.3.17.1.3 Kirtland AFB. Interfaces with the commercial long-line systems at Kirtland exist, but all circuits off-base would have to be routed to the Albuquerque main exchange.

2.7.3.17.2 Local Telephone Support. Local telephone company capabilities were surveyed to determine whether any problems would be anticipated in meeting the following requirements:

- An administrative telephone system of approximately 1000 lines and 1800 instruments. It is expected that this requirement will be met by making the CSOC's facility system a satellite of the main telephone exchange(s) which support the base.

- An operational/tactical telephone system, secure intercom system, and other special features.

- Personnel to maintain the above operational/tactical systems.

2.7.3.17.2.1 Malmstrom AFB. The installation of communications equipment is required. The cabling system and exchange for Malmstrom AFB and its SAGE building are leased from the local Mountain Bell Telephone Company. The base telephone exchange, building 1082, has a capacity of 1600 lines and is expected to be 60% filled after the disestablishment of the 17 DSES and SAGE Center. The SAGE exchange has a capacity of 400 lines; however, it would have to be replaced due to its small size and it does not have the features required by operational/tactical communications systems. Local communications people do not foresee any problems in meeting the other communications requirements.

2.7.3.15.2.2 Peterson AFB. Cable and switching installation is required. The exchange is a #5 Cross-Bar CENTREX with a 2800 line capability expandable to 5000

lines. The exchange is 42% filled. A cable to the proposed site does not exist at present. No problems are anticipatd in meeting other communications requirements.

2.7.3.15.2.3 Kirtland AFB. The cable to Manzano would have to be expanded. The exchange and cable systems are government owned. The telephone exchange is programmed to be converted to an Electronic Switching System (ESS) in May 1980 with a 16,000 line capability, expandable to 24,000, if required. The projected line fill of the ESS is 75%. Base cabling does exist to the Manzano complex; however, 1300 of the 1900 cable pairs are filled, and 300 of the 600 unfilled pairs are programmed for non-CSOC functions. To meet requirements (1000 circuits), the cable pairs would have to be expanded or multiplexing carrier equipment would have to be installed using existing cable pairs. Because of the major modifications often required to establish operational/tactical communications systems which support the facilities command and control, a leased system would better meet CSOC requirements. A government owned and maintained system does not provide the flexibility required for the operational/tactical requirements.

2.7.3.17.3 Local Base Telecommunications Services. The local telecommunications services include the following services:

(1) AUTOSEVOCOM (Requirement: 15-30 terminals)

(2) Dedicated teletype circuits and an AUTODIN terminal.

(3) AUTOVON (Requirement: 30 AUTOVON circuits.)

2.7.3.17.3.1 Malmstrom AFB. Option B would require significantly greater cost for communications support than Option A. The base has an AUTOSEVOCOM terminal located in the SAGE facility (five out of six drops on base terminate at SAGE and would be available upon SAGE disestablishment). The base has three telecommunication systems consolidated into one telecommunications center in the SAGE building. The systems are ideally located to support the proposed CSOC location, Option A. Option B requires cable and multiplexing carrier and possibly a remote AUTODIN terminal.

2.7.3.17.3.2 Peterson AFB. Cable installation to the remote site is the major requirement. An FTC-31 switch located at the Cheyenne Mountain Complex supports Peterson's AUTOSEVOCOM requirements. An expansion to this facility is not anticipated to meet the proposed project requirements. A Univac 418II AUTODIN terminal (Chidlaw Building) with a DCT 9300 remote (at Peterson) supports present AUTODIN

requirements. As a result of ADCOM realignment, new AUTODIN terminals will be placed at Peterson and should support CSOC without expansion.

2.7.3.17.3.3 Kirtland AFB. The base has an AUTOSEVOCOM facility/SECORD located in the base communications building. Five drops off the SECORD are being used at present. A minimum of three additional SECORDs may have to be installed between Kirtland and proposed CSOC location to meet AUTOSEVOCOM requirements. The base telecommunications center uses a DCT 9300 2.4K band circuit which can be modified to accept a remote terminal in the Manzano complex.

2.7.4 BOS Summary: All three candidate sites, Malmstrom, Peterson, and Kirtland can support the BOS requirements of CSOC without significant impact on the host. The only notable facility impact would be the requirement to construct a fire station to support the proposed CSOC location at Peterson AFB. The manpower impact (requirement to increase authorized manning in various BOS functions) was slightly higher at Kirtland than the other candidates. This was due primarily to the fact that Kirtland is experiencing sustained growth, while Peterson is undergoing limited expansion (ADCOM realignment) and Malmstrom's population is declining (disestablishment of 17th DSES and SAGE center). However, both Peterson and Malmstrom are projected to lose BOS authorizations in the future, and as a result, the differences in manpower impact on the candidates would be almost insignificant. Some observations were readily apparent for purposes of differentiation: the quantity of on-base housing which would be available for CSOC was significantly greater at Malmstrom; the condition of facilities (particularly MWR) was significantly better at Peterson; the base medical facilities (availability of specialty care and number of beds) were significantly better at Kirtland. The differences in other areas: administrative services, CBPO, CCPO, JAG, etc., were relatively minor. Since no candidate in terms of BOS was clearly superior to tne others, BOS is not a predominate factor for preferred candidate selection.

2.8 WX Attenuation: Locate CSOC in an area with sufficiently favorable weather (WX) to insure high availability of satellite-to-ground communication links at K-Band frequencies.

2.8.1 Rationale. A requirement exists in the mid-1980's to accommodate greatly increased mission data rates between DOD satellites and ground terminals and to support the use of a DOD data relay satellite. High data rates require extremely large bandwidths which are achieved by

using millimeter wave communications. These high frequency waves are attenuated by atmospheric moisture, water vapor, and precipitation to the extent that significant disruptions in data links can occur. A comparison of atmospheric signal degradation at various sites, for a 99.9% communications availability, shows that approximately a 30dB variation is possible between the site and satellite system due to weather.

2.8.2 Impact if Not Satisfied. Without compensation for atmospheric attenuation, a lower communications link availability must be accepted, with the possible resultant loss of mission data. Attenuation can be partially compensated for by increasing equipment performance. However, satellite performance improvements could become prohibitively expensive in terms of satellite subsystems, weight, and increased risk of failure. Alternatively, it is possible to use two ground terminals (separated approximately 20km) in a spatial diversity arrangement. Spatial diversity reduces the effect of rain attenuation because heavy precipitation tends to be very localized. Thus, the outages at the two terminals (due to atmospheric conditions) are independent rather than simultaneous. The additional terminal increases system acquisition and O&M costs and its operational complexity.

2.8.3 Assessment. Table 1 illustrates the estimated potential atmospheric signal degradation due to weather attenuation at each of the three sites under consideration. Shown is a conservative (worst case) condition which employs an antenna elevation of 10 degrees, a transmitted frequency of 31 Ghz and requiring 99.9 percent availability. The rain margin criteria is what losses would normally be expected during periods of rain, clouds, and moisture at the three sites under three levels (10dB, 20dB, 30dB) of antenna design. The rain margin is a design requirement to overcome the losses indicated for a 1.4 minutes per day outage (estimated to be an acceptable degradation under the conditions described above). The rain margin criteria and the rain margin are shown simultaneously, but are simply two different methods of viewing the weather attenuation criteria.

TABLE 1

DOWNLINK RAIN MARGIN AND COMMUNICATIONS OUTAGE FOR VARIOUS RAIN MARGIN DESIGN CRITERIA

(At 31 GHZ with a 10 degree Elevation Angle

and a 99.9% Antenna to Satellite Link Availability)

	**Rain Margin Criteria % (Min/Day)			*Rain Margin (dbm)
	10DB	20DB	30DB	
Kirtland AFB	0.34	0.09	0.04	18
	(4.76)	(1.26)	(.56)	
Malmstrom AFB	0.41	0.10	0.05	20
	(5.74)	(1.4)	(.70)	
Peterson AFB	0.84	0.21	0.09	28
	(11.76)	(2.94)	(1.26)	

*Rain margin is the attenuation loss due to rain, clouds, and moisture only.

**0.1% outage is equivalent to 1.4 minutes per day.

2.8.3.1 Malmstrom AFB. An antenna deployed at 10 degrees elevation and operating at a 31 Ghz frequency would require a 20dB compensation to achieve a 99.9 percent link availability or a possible degradation of no more than 1.4 minutes per day. The 1985 technology risk assessment is considered to be moderate for the 20dB capability to overcome weather attenuation. Alternatively, the acceptable daily degradation potential duration could be adjusted.

2.8.3.2 Peterson AFB. Under the stated conservative conditions, a 28dB antenna would be required to maintain 99.9 percent link availability (possible degradation of no more than 1.4 minutes per day). The 1985 technology risk assessment is considered to be moderate to high for the 28dB capability. Antenna diversity (reference para 2.8.2) or adjustment to the acceptable amount of daily degradation are alternatives to the moderate technology risk.

2.8.3.3 Kirtland AFB. Under the stated conservative conditions, an 18dB antenna compensation would be required to maintain 99.9 percent link availability (possible degradation of no more than 1.4 minutes per day). The 1985 technology risk assessment is considered to be moderate. An alternative to the moderate risk technology is an adjustment to the acceptable duration of daily degradation due to weather alternation.

2.9 Physical Threat. Locate CSOC away from population concentrations, roadways, and public areas.

2.9.1 Rationale. Siting CSOC so as to limit awareness of and to restrict access to the facility improves security.

2.9.2 Impact if Not Satisfied. A lack of isolation would increase vulnerability to sabotage, civil disturbances, and terrorist activities. Protection costs for this Priority A facility would be greater if CSOC were located close to heavily populated areas, transportation corridors, etc.

2.9.3 Assessment.

2.9.3.1 Malmstrom AFB. Both option A&B meet this criterion. At Malmstrom, all facilities are located on Malmstrom AFB proper. In Option A, the technical and E&A facilities are located in the center of the base and are

surrounded on all sides by base acreage and facilities. The antenna field in Option A and all major facilities in Option B are located near the southern boundary of the base. The closest public access is immediately south on the US Highway 87/89 right-of-way which is approximately 1,500 feet from the site. A small ridge between the Option B location and the highway reduces visibility to the public.

2.9.3.2 Peterson AFB. The remote site has sufficient land for ease in providing Priority A resource protection. All CSOC technical support facilities (including technical, engineering, administration, and support) are located approximately eight and a half miles east of Peterson AFB (eleven miles by road). The site is away from population concentrations, major roadways, and other public areas.

2.9.3.3 Kirtland AFB. All CSOC facilities at Kirtland AFB meet this criteria. The technical, engineering, administrative, and support facilities are located within the heavily guarded Manzano area. Four separate (some electrically charged) security fences currently surround the entire area plus the area is under continuous security patrol. The antenna site, located outside the existing fenced area, is well within the Kirtland AFB property and should present no obstacles in providing Priority A resource protection.

2.10 EXPANSION: Locate CSOC to provide a capability for future expansion.

2.10.1 Rationale: Additional land should be available to support important long-range planning objectives; new space programs could be located at the facility with minimal impact; additional antenna systems could be accommodated; and future K-Band antennas could be dispersed to minimize the impact of localized weather conditions.

2.10.2 Impact if Not Satisfied. Selecting a site with limited growth potential would preclude the future collocation of other space programs and the implementation of equipment dispersal options, or alternately, would make these actions much more expensive.

2.10.3 Assessment.

2.10.3.1 Malmstrom AFB: Malmstrom AFB meets the minimum land requirements; it has limited expansion capability. Minor expansion in the vicinity of the SAGE building (Option A) would require demolition of the Minuteman AFIT Facility (Bldg 548) and relocation of parking areas

antenna field (either option) requires placement of antennas closer to the active runway. In summary, future expansion at Malmstrom AFB is possible but limited.

2.10.3.2 Peterson AFB: The acreage east of Peterson AFB satisfies this criterion. Substantial expansion room is provided by the 640-acre parcel, and further expansion is facilitated by the fact that the parcel adjoins additional state land.

2.10.3.3 Kirtland AFB: The Manzano area of Kirtland satisfies this criterion. Manzano has adequate acreage for the CSOC complex and for future expansion.

2.11 FEDERAL PROPERTY: Locate CSOC on Federal property.

2.11.1 Rationale. The project implementation plan imposes critical schedule constraints on the CSOC program. The time and cost necessary to procure nonfederal property may require approximately one year following normal government land procedures for land acquisition. Land purchases over $50,000 require approval by the Secretary of the Air Force, Office of the Secretary of Defense, Office of Management and Budget as well as Congressional authorization and appropriation.

2.11.2 Impact if Not Satisfied. A decision to purchase privately-owned land may necessitate additional military construction funds to be authorized and appropriated by Congress. Land acquisition costs would increase overall program expenditures.

2.11.3 Assessment.

2.11.3.1 Malmstrom AFB: All proposed locations at Malmstrom AFB are on Federal property.

2.11.3.2 Peterson AFB: Peterson AFB offers sufficient land on base, but the location does not meet other criteria, specifically EMR/EED hazards and the 1,000-ft buffer. However, three parcels 6-10 road miles east of Peterson have been identified as potential locations for CSOC - two 640-acre sections of State-owned property, and a 740-acre parcel of privately-owned land (currently not listed for sale).

2.11.3.3 Kirtland AFB: All proposed locations at Kirtland AFB are on Federal property.

2.12 TRANSPORTATION: Locate CSOC within 50 miles of an airport with regularly scheduled airline service.

2.12.1 Rationale. In the event of satellite malfunctions or critical operations, experienced technical personnel may be required to travel on short notice to the CSOC facility from satellite program offices and contractor facilities. These rapid relocation requirements dictate the presence of adequate airline service in the vicinity of the facility.

2.12.2 Impact if Not Satisfied. Failure to support some satellites during critical mission periods could result in either loss of those satellites or severe mission degradation.

2.12.3 Assessment.

2.12.3.1 Malmstrom AFB: Airline transportation at Malmstrom AFB is marginal. Great Falls International Airport is 15 miles from the base and within the specified mileage. The service is considered marginal because there are no nonstop direct flights from San Francisco/San Jose, Los Angeles, nor Washington, D.C. and the number of daily connecting flights is low. Three major airlines service Great Falls. They are Western, Northwest Orient, and Frontier. Daily flights as of 1 July 1979 are:

	From Great Falls:	To Great Falls:
San Francisco	1 flight (intermediate stops)	1 flight (intermediate stops)
	4 flights (intermediate flight changes)	3 flights (intermediate flight changes)
Los Angeles	2 flights (intermediate stops)	2 flights (intermediate stops)
	5 flights (intermediate flight changes)	3 flights (intermediate flight changes)
Washington DC	1 flight (intermediate stops)	0 flights direct
	5 flights (intermediate flight changes)	7 flights (intermediate flight changes)

2.12.3.2 Peterson AFB: Airline transportation at Peterson AFB is adequate. The closest commercial airport is Colorado Springs (joint use with Peterson) and the terminal is two miles from the base. There are four major airlines that service Colorado Springs. They are Continental, Braniff, Frontier and TWA. Daily flights as of 1 July 1979:

	From Colo Springs:	To Colo Springs:
San Francisco	3 flights (intermediate stops)	2 flights (intermediate stops)
	2 flights (intermediate flight changes)	5 flights (intermediate flight changes)
Los Angeles	1 flight (direct)	1 flight (direct)
	4 flights (intermediate stops)1	4 flights (intermediate stops)
	9 flights (intermediate flight changes)	6 flights (intermediate flight changes)
Washington DC	1 flight (intermediate flight stops)	0 flights (without flight changes)
	8 flights (intermediate flight changes)	10 flts (intermediate flight changes)

2.12.3.3 Kirtland AFB: Airline transportation at Kirtland is excellent. Albuquerque International's main terminal is south of the east/west runway (joint use with Kirtland). The terminal is approximately nine miles from the proposed CSOC location. Scheduled daily flights as of 1 July are:

	From Albuquerque:	To Albuquerque:
San Francisco	4 direct flights	4 direct flights
	15 (intermediate flt changes)	11 (intermediate flt changes)
Los Angeles	10 direct flights	8 direct flights
	6 (intermediate flt changes)	7 (intermediate flt changes)
Washington DC	2 direct flights	2 direct flights
	15 (intermediate flt changes)	29 (intermediate flt changes)

2.2.1.2.1 The significance of the EED hazard to aircraft operations at candidate STC II sites is a function of the location of the antenna field relative to the runway(s) and traffic patterns. Accordingly, the potential impact at each site is addressed base-by-base in paragraph 2.2.4.

2.2.2 General Physical and Biological Factors. Water resources are adequate to supply the projected needs of all sites under consideration, with the exception of Sites 1B and 2 at Luke AFB and Site 1A at Cheyenne Mountain. At Luke, no water supply is currently available and wells or other sources would have to be developed. At the top of Cheyenne Mountain where the antenna field would be located, water would have to be pumped to the site from the main water line supplying the interior mountain facilities. At other sites, water is obtained from on-base wells or other local sources and is of fair to good quality. Storm drainage is adequate at all sites with the exception of Site 1 at Luke AFB and Nellis AFB, which were discussed earlier. The site at Offutt AFB is located within the 100-year floodplain of the Missouri River and will require flood protection measures to be incorporated into the design of the facility.

2.2.2.1 With the possible exception of a few native grasses and local vegetation, no significant impact will occur to biological (flora and fauna) resources at any of the sites. However, at Duluth and Hancock Field it will be necessary to remove dense stands of native trees. No endangered species of vegetation or wildlife have been identified for the specific sites under consideration.

2.2.2.2 No unique geologic or landform characteristics were identified at any sites which could be impacted by construction or operation of the proposed facility, with the possible exceptions of Site 1 at Luke AFB and Site 1A at Cheyenne Mountain. A salt dome underlies Luke AFB in the area where Site 1 is located. The potential impact of this formation was discussed in paragraph 2.1.3.1.1. At Site 1A, Cheyenne Mountain, the antennas would be constructed on the top of the mountain which is part of the geological landform comprising a highly significant ridgeline visible from other mountains nearby and from Pikes Peak Valley to the south and east. The presence of the antennas on the ridgeline and the grading scars resulting from construction of the access road connecting the antenna field with the remainder of the facility located inside the mountain could represent adverse aesthetic impacts on the present landform of Cheyenne Mountain.

the CSOC is remote from the transceiver, additional costs and operational impacts could be incurred to transmit high data rate information between the transceiver and the CSOC.

2.14.3 Assessment. Malmstrom AFB and Peterson AFB do not satisfy this criterion. Kirtland AFB does. Recurring costs would be incurred for Malmstrom or Peterson in order to relay downlink data (from payloads aboard the shuttle) from NASA's TDRSS ground terminal at White Sands, NM, to the CSOC. The costs are a function of the downlink data rate. For data rates comparable to those of satellite supported by the AFSCF today, the costs would approximate $200K per year. For payload downlinks which fully exploit shuttle communications capabilities; i.e., science/experiment data at 50 megabits per second (Mb/s), the costs would amount to about $500K per year. TDRSS may also be used for direct support of mission satellites. Shuttle constraints do not apply under these circumstances, and downlink data rates of, say, 200 Mb/s are possible. Relay of the data from White Sands to CSOC would cost approximately $2 million per year for Malmstrom or Peterson AFBs. Recurring expenditures of this magnitude may require alternative means of meeting this criterion. Alternatives include: Collocation of a DOD-data processing/handling at White Sands to reduce data rates to economic levels; augmentation of the TDRSS system to allow direct coverage at Malmstrom or Peterson; or deployment of a TDRSS-like system to meet DOD requirements. These options, as well as the locating of a TDRSS ground station at Kirtland, have substantial acquisition and O&M costs.

2.15 REGIONAL SUPPORT: Locate CSOC within convenient commuting distance of a large city (population 100,000 or more) to provide housing, community support services, cultural attractions, recreational facilities, educational opportunities and a source of technically trained personnel.

2.15.1 Rationale. The operations concept for the facility requires large numbers of highly qualified personnel, both military and contractor. Available community amenities should be such that it is possible to attract and retain the caliber of contractor and military personnel required to support the mission. The community must also be capable of expanding its housing sufficiently to absorb a large contingent of as many as 5360 personnel, including families. The Air Force could provide military family housing through the MCP, if there is sufficient land, but the contractor employees and families must also have adequate housing. Current Air Force standards require housing to be within a one hour drive to be considered adequate. Although driving time varies considerable with

traffic, road conditions, and weather, about 30 miles is a reasonable upper limit on commuting distance.

2.15.2 Impact if Not Satisfied. Attracting contractor personnel to an area lacking these qualities may incur higher O&M costs. Locating personnel in an unattractive area would increase the difficulty of obtaining highly qualified engineers, managers, and technicians and complicate the establishment of equitable assignment policies for military personnel. The major impact, however, could be the added cost of military family housing if required.

2.15.3 Assessment. Regional support is addressed under the following topics:

(1) Off-base housing.

(2) Educational opportunities.

(3) Community support services.

(4) Cultural/recreational attractions.

(5) Labor force.

2.15.3.1 Off-base Housing.

2.15.3.1.1 Malmstrom - Great Falls, Montana: There are approximately 1300 single family dwellings presently on the market and approximately 380 additional units will be available for purchase upon disestablishment of the 17th Defense Systems Evaluation Squadron and 24th NORAD Region SAGE unit. Single family homes are predominantly 3 bedroom units, using natural gas utilities, in the $55,000 to $60,000 price range. Housing starts decreased in 1978 and 1979 due to the increasing number of resales on the market. In 1977, 716 units were constructed. In 1978, housing starts declined to 342 units, and through August 1979, 106 units were constructed. Rental unit availability averages 1500 units per month. Units consist of both 2 and 3 bedrooms in the $235 to $375 per month price range.

2.15.3.1.2 Peterson - Colorado Springs, Colorado: Projected vacancies of single and multi-family dwellings after ADCOM realignment is approximately 2,400. Housing starts are approximately 350/month and should continue at this rate due to expansion of technical industries in the area. Family houses are predominantly 3 and 4 bedroom units, most in the $50,000 - $100,000 price range although many are available at lower or higher costs. Natural gas is

the primary energy source for heating. Rental units (primarily unfurnished, two bedroom, $175-$250/mo) average 6 percent vacancy which presently equates to 1600 vacant units.

2.15.3.1.3 Kirtland - Albuquerque, New Mexico: As of September 1979, there were approximately 4550 family units presently on the market and about 492 additional family houses per month and approximately 526 apartments per month being constructed in the Albuquerque area. Single family homes are predominantly 3 and 4 bedroom units with the median price about $60,000 and ranging from about $60,000 to $90,000. Additionally, a major new housing development of some 2000-2500 houses is being constructed of moderate cost. Units will come on the market in the 1980-1981 time frame and are expected to cost about $45,000 to $50,000 for two and three bedroom units.

2.15.3.2 Educational Opportunities: The section addresses higher education only. Primary and secondary education is discussed in the Community Support Services section.

2.15.3.2.1 Malmstrom - Great Falls, Montana: College of Great Falls (CGF) is the single institution of higher education in the city. CGF is a fully accredited, four-year liberal arts college offering B.A. and B.S. degrees and teaching certificates. The college, operated by the Sisters of Charity, is co-educational and open to students of all faiths.

2.15.3.2.2 Peterson - Colorado Springs, Colorado: The area hosts one university (University of Colorado at Colorado Springs), the USAF Academy, eight colleges, and numerous community colleges. Most disciplines are offered and degrees range to doctorial programs. The community colleges offer a wide range of trade and vocational programs.

2.15.3.2.3 Kirtland - Albuquerque, New Mexico: The area hosts two universities, the University of New Mexico with an enrollment of about 22,000 and the University of Albuquerque with an enrollment of about 2,300. Additionally, there are two smaller private colleges in Santa Fe, about 50 miles away, with an enrollment of about 1,400. The New Mexico Institute of Mining and Technology at Socorro is located about 70 miles away. All of these colleges are fully accredited, four-year programs offering most disciplines with degrees ranging to doctorate.

2.15.3.3 Community Support Services:

2.15.3.3.1 Malmstrom - Great Falls, Montana: Primary and secondary schools consist of two public senior high schools, four public junior high schools, 18 public elementary and five parochial elementary schools. In addition, a State-operated school for deaf and blind students is located in Great Falls. Because of declining enrollment, five elementary schools were closed in Great Falls during the past year. The decline in enrollment is expected to continue in the immediate future but at a reduced rate. One public library with 140,000 volumes is available in Great Falls. Local medical facilities consist of two medical centers offering most specialist care. Numerous churches representing 32 denominations are located in the city.

2.15.3.3.2 Peterson - Colorado Springs, Colorado: Primary and secondary schools consist of 15 public senior high schools, 25 public junior high schools, 76 public elementary, one parochial elementary, and one private elementary school. The Colorado Springs School for the Deaf and Blind serves handicapped students. The public school system is presently operating at 75% of capacity.There are 13 public libraries, one with bookmobile service to outlying areas.

There are nine local medical facilities with 1,418 total bed capacity. Number of churches is 126 Protestant, ten Catholic, one Jewish and five others.

2.15.3.3.3 Kirtland - Albuquerque, New Mexico: Primary and secondary schools consist of ten public senior high schools, 22 public junior high schools (grades 6-8) and 73 public elementary schools. Additionally, private and parochial schools provide 18 more high schools, junior/middle schools, and elementary schools. These schools represent a total enrollment of about 85,000 which has remained fairly constant for the past 6 years. Schools are operating at about 80% of capacity. Additionally, the Albuquerque Technical-Vocational public school is a major facility with a day enrollment of about 3200 and an evening enrollment of 5000. In addition to the two university libraries, the city operates a major library system with eight branches in various areas of the city with a total of some 1.5 million volumes. There are 12 medical facilities in the area with about 21,200 bed capacity. These include a VA hospital with 442 beds, a 64-bed Indian hospital, and a 44-bed mental health and retardation center. There are numerous churches throughout the city - 264 Protestant, 37 Catholic, three Jewish, 13 Mormon and six others.

2.15.3.4 Cultural/Recreational Attractions:

2.15.3.4.1 Malmstrom - Great Falls, Montana: Cultural attractions include a youth symphony orchestra, the C. M. Russell Art Gallery and Studio, a cultural center (fine arts), summer stock theater, and a museum displaying early agricultural equipment. Recreational attractions include professional baseball and hockey teams, tennis clubs, three golf courses, and State fair and rodeo. The predominent recreation is outdoor activities such as fishing, hunting, camping and skiing. Two national parks (Yellowstone and Glacier) and numerous State parks are within a half-day drive of Great Falls.

2.15.3.4.2 Peterson - Colorado Springs, Colorado: Cultural attractions include 13 major museums and galleries, a symphony orchestra, and several fine arts theaters and cultural centers. Recreational attractions include 76 public parks, a zoo, 12 golf courses, professional baseball and hockey and several indoor/outdoor tennis, ice skating, and swimming facilities. Outdoor recreation is predominant - skiing (20 major ski areas), hunting, fishing and camping are available in the nearby Rockies. In addition, the City of Denver (60 road miles north) has all the attractions normally associated with a large metropolitan area.

2.15.3.4.3 Kirtland - Albuquerque, New Mexico: Cultural attractions include 16 theaters, symphonies and an opera providing in total, over 400 productions per year. Other major cultural attractions include four museums, 13 golf courses, 29 swimming pools, 13 bowling alleys, 11 community centers, a zoo, a triple A farm club professional baseball team, two roller skating rinks and one ice skating rink, the State fair grounds and numerous other local recreational and park facilities. The predominant recreation is outdoor activities such as fishing, hunting, riding, camping and skiing. There are ten national monuments, one national park and five State parks in the State drawing some 5.7 million visitors annually.

2.15.3.5 Labor Force:

2.15.3.5.1 Malmstrom AFB - Great Falls Montana: A breakdown of the local labor market follows:

	Cascade County	Great Falls
Population (Aug 77)	81,804	60,091
OCCUPATION BY CATEGORY		
	Total	Total

Category	Cascade County	Great Falls
Total Employed, 16 yrs & over	26,271	21,304
Professional, technical &		
Kindred Workers	3,939	3,429
Health Workers	755	657
Teachers, Elementary & Secondary	1,118	950
Managers & Administrators, except farm	2,780	2,470
Salaried	2,262	2,030
Self-employed in Retail Trade	273	233
Sales Workers	2,192	1.986
Retail Trade	1,141	871
Clerical & Kindred Workers	4,828	4,263
Craftsmen, Foremen, & Kindred		
Workers	3,531	2,765
Construction Craftsmen	967	713
Mechanics & Repairmen	1,009	770
Operatives, except Transport	1,700	1,373
Transport Equipment Operatives	1,012	803
Laborers, except Farm	1,356	1,059
Farm Workers	1,025	209
Service Workers	3,634	2,843
Cleaning & Food Service Workers	2,136	1,632
Protective Service Workers	226	184
Personal & Health Service		
Workers	976	792
Private Household Workers	274	193
Female Employed, 16 Yrs & Over	10,039	8,376
Professional, Technical and		
Kindred Workers	1,791	1,509
Teachers, Elementary & Secondary	763	632
Managers & Administrators, except		
Farm	501	711
Clerical & Kindred Workers	3,673	3,242
Secretaries, Stenographers &		
Typists	1,239	1,110
Operatives, including Transport	382	317
Other Blue-Collar Workers	228	180
Farm Workers	38	9
Service Workers Except Private		
Households	2,329	1,775
Private Household Workers	257	187

SOURCE: U.S. Census, Tables 87 and 123 (Updated: 1977)

2.15.3.5.2 Peterson AFB - Colorado Springs, Colorado: A breakdown of the local labor market follows:

	City of Colorado Spgs	El Paso County Metro Area
Population (1979)	230,600	333,000

Total Employment (Dec 78)

Manufacturing	12,120
Trade	23,880
Services	22,160
Government	22,730
Transportation, Communication and Utilities	4,270
Contract Construction	5,930
Finance	5,200
Mining	190
All Other	17,750
TOTAL	114,230

Unemployment 4.5% of Labor Force (Dec 78)

LABOR AVAILABILITY:

Occupational Category	Male & Female
Professional, Technical, Managerial	2,167
Clerical and Sales	2,941
Service	2,033
Farming, Fishing, Forestry, etc.	316
Processing	57
Machine Trades	515
Bench Work, Assembly	751
Structural Work	1,420
Miscellaneous	1,040
	11,240

(Active applications on file as of Feb 79, Colorado Springs Job Service Center, State Employment Service) REVISED: Mar 79

2.15.3.5.3 Kirtland AFB - Albuquerque, New Mexico

	Metro Albuquerque Area	
Population (July 77)	401,900	
Non Agricultural Employment (1978)	177,800	
Construction	15,100	
Manufacturing	17,200	
Durable Goods		11,800
Nondurable Goods		5,400
Transportation & Public Utilities	10,200	
Transportation		5,200

Communications		3,200
Electric, Gas & Sanitary Svcs		1,800
Trade	45,300	
Wholesale		12,000
General Merchandise Stores		4,800
Food Stores		3,500
Auto Dealers & Service Stations		4,400
Eating & Drinking Facilities		10,000
Other Retail Trade		9,700
Finance, Insurance & Real Estate	10,000	
Banking		2,500
Insurance		3,300
Real Estate & Other Finance/ Insurance		4,300
Services	40,000	
Lodging		2,600
Health Services		8,800
Social Services		2,900
Other Services		25,700
Government	39,300	
Federal		12,000
State		10,000
Local		17,900

Unemployment Rate of 5.5% for 1978

Source: New Mexico Department of Human Services, Employment Services Division.

2.16 FACILITIES: Locate CSOC to take maximum advantage of existing building/facilities.

2.16.1 Rationale. Use of existing facilities could offer some savings, depending on the type of facilities available. A conscientious effort should be made to use existing facilities (in lieu of building new facilities) wherever such use is cost-effective.

2.16.2 Impact if Not Satisfied. Failure to use existing facilities may result in increased project costs.

2.16.3 Assessment.

2.16.3.1 Halmstrom AFB: Malmstrom AFB has considerable unused or underused facilities (Figure 2), a portion of which can be employed for CSOC use. In Option A, the SAGE building (Bldg 500) along with nearby building 548 can adequately meet the CSOC Engineering and Administration (E&A) and Support requirements. The E&A and support square footage requirements are:

Function	Engineering/Administrationl	Support	Other
SOC	55,800	23,000	2,300
SOPC	12,400	400	
OTHER	13,000	12,000	
Total	81,200	35,400	2,300
Total CSOC (sq ft)			118,500

The technical facility would be constructed adjacent to Bldg 500. Conversion of the SAGE site to meet technical requirements is not considered economically feasible. Building 500 was considered for the technical support requirements for CSOC. However, the present configuration of floors, walls, ductwork, cable runs, etc., is so totally different from that required for CSOC technical requirements that the only reasonable solution is to completely gut and rebuild the entire building. This includes removal of all interior non-load bearing walls, ceilings, light fixtures, wiring, air conditioning and heating ducts, and plumbing. The remaining empty shell of walls, floors, and a roof must then be completely refinished on the inside to include the raising of flooring for computers, dropping ceilings for air conditioning return plenums, installing fire protection--both water and Halon systems, redoing interior finishes, and making various repair and rehabilitation to floors and walls. A completely new electrical and air conditioning system must be installed. These alterations would cost about 90% of completely new construction. Another significant problem is that the existing SAGE building is not Electromagnetic Pulse (EMP) protected. At present the most reasonable approach to providing EMP protection is to protect the entire technical facility and the power plant. Many technical problems would complicate an attempt to protect only a portion of a building which has many interfaces with the remainder of the building. EMP protection in a new facility increases the cost by about 15%. Applying EMP protection to an existing building is much more complex and may cost an additional 30-50%. However, as an alternative, Bldg 500, with about 120,000 sf, is suited to accommodate the CSOC E&A support function at an estimated cost for alteration of about $2.7 million. The other existing buildings could be adapted for technical use, however, they are distributed and would satisfy only a small portion of this requirement. Furthermore, technical alteration costs are greater than that required for

modifying the same facilities for E&A use. In Option A, Bldg 500 satisfies the entire E&A requirement and a new 352,000 sf technical building could be constructed adjacent to it, and the antennas would be remoted (Fig 3), this configuration will satisfy all floor space requirement. The option uses the existing power plant of the SAGE facility with additions/modification to meet CSOC needs. In Option B, Bldg 145 (approximately 34,000 square feet) and Bldg 1441 (approximately 22,000 square feet) would be used for the partial fulfillment of the E&A support requirements. With this alternate configuration, the total technical building, the remaining portions of support building, and antenna field requirements would be met by building a new facility southeast of the runway.

2.16.3.2 Peterson AFB: Few existing facilities were identified at Peterson AFB (Figure 7) for potential project use. Space is at a premium throughout the base because HQ NORAD/ADCOM functions are being transferred from the Chidlaw Building in downtown Colorado Springs to Peterson AFB as part of the ADCOM reorganization. Three existing facilities were identified and investigated for use by CSOC. They are Buildings 114, 119, and 130. All are World War II vintage hangars, having steel frame construction with wooden roof trusses (except one has steel trusses) and sheet metal covering skin. Each has 10,000 to 11,000 square feet of floor area. All the hangars are considered substandard but upgradeable (Condition Code II). They are empty except for some minor miscellaneous use such as indoor tennis courts, storage, etc. These buildings could be upgraded for administrative use to satisfy part of the E&A requirements of the SOC but at considerable cost. Essentially, a new facility would be constructed within the shell of the hangars at a cost approaching the cost of a completely new building. The location at the flight line with high jet engine noise level is not suitable for an administrative function, and retention of the hangars in their present configuration will widen the possible options for future flying mission support. Approximately 22,000 sq ft could be used for storage. The Chidlaw Building under lease by GSA, although suitable as an E&A and Support facility, was not considered feasible due to the distance to the primary site location, greater than 15 miles.

2.16.3.3 Kirtland AFB: Approximately 119,000 square feet of administrative space was identified at the Manzano complex for possible CSOC engineering administration and support use. (See figure 11). None of the available facilities were suitable for technical requirements. Building 30143 (approximately 60,000 SF) would become the primary engineering and administrative are with building

30126 (approximately 4000 SF) used for a classified conference room. Building 30133 (12,142SF), a previous dining facility, would be used in that capacity. Buildings 30130 and 30132 would be used as secondary E&A support space. Building 30128 (approximately 12,000 SF) would be used for primary support/logistics space. The remaining building 30131 (approximately 3000 SF) would be retained in its present configuration for possible future use. Every consideration was given to using the existing available facilities. The only new construction required will be for a technical building (350,000 sq ft).

2.16.3.3.1 (C) These available facilities are located near an explosive storage area, in violation of the explosive safety distance of 1250 feet (inhibited building distance). The facilities were built to interline distance criteria since the people based in the facility were in direct support of the explosive storage funcition. Proposed use of these facilities for CSOC would place military, civil service, and contractor personel within this explosive zone in violation of the safety standard. This may create OSHA and labor union problems. A coordinated Kirtland AFB and Sandia Labs message presented a workaround that would essentially reduce the safety distance zone to allow use of the Manzano facility by CSOC.

III
ENVIRONMENTAL ANALYSIS

3.0 Summary of Environmental Analysis.

3.1 Basis for Analysis. Each of the three proposed locations (Malmstrom, Peterson, and Kirtland) were evaluated for potential biophysical impacts from the proposed action. The evaluations were limited to discussions with the Base Environmental Protection Planners and review of the TAB A-1 Environmental Narrative and other published environmental data. No contacts were made with City, County, or State environmental offices.

3.1.1 Findings. No major environmental problems were identified for each of the proposed locations. However, the potential exists at each of the locations for significant impacts upon the environment. Also, since all of the construction requirements are not yet finalized, a more detailed environmental analysis must be accomplished before a final determination can be made.

3.1.2 Land-Use. The proposed action will change land uses (depending on the project location, approximately 400 acres) at each of the locations. The greatest impact will be at Peterson since the project site is off-base and on grazing land, presently State or privately owned. Malmstrom and Kirtland project sites are on base undeveloped land.

3.1.3 Air Quality. Each of the locations has been designated as a non-attainment area for some pollutants. Increased emissions from the proposed action are principally from the addition of more vehicles into the area.

3.1.4 Water/Waste Water/Solid Waste. With the exception of the off-base site at Peterson, adequate water supplies are available nearby to the project sites. Adequate waste water treatment and solid waste disposal capacities are available at all of the locations.

3.1.5 Electrical Power/Heating. All of the locations will require extension of electrical power lines to the project site. Greatest impact would be to the Peterson site which is seven to ten miles from the base. Natural gas is extensively used at each of the locations. The proposed action could accelerate shortage of natural gas supplies. Malmstrom and Kirtland presently have plans to convert to coal burning heating plants in the future.

3.1.6 Archaeology. Kirtland is the only location where archaeological surveys have been performed.

Archaeological findings (Pueblo Indian Traces) have been made in the area approximately one mile from the project site. This survey should be extended to cover the project site. Also, investigations should be made of the Peterson and Malmstrom sites for potential archaeological finds.

3.1.7 Electromagnetic Radiation Hazards (EMR). Adequate acreage is available at the three locations to minimize EMR hazards. For potential future missions, Malmstrom may require additional criteria distances for EMR hazards because of the location of on-base acreage. However, because of increased public interest in the potential hazards of EMR to base personnel and the general public, a more detailed analysis is required for all locations.

3.1.8 Construction Impacts. The proposed action would result in significant major new construction at all of the proposed locations. New facilities totaling in excess of approximately 400,000 SF may be required depending on the location.

3.1.9 Socioeconomic. The population increase (including dependents) from the proposed action would have the largest impact in the Great Falls area (approximately a 6.0 percent increase in the total population). The least impact would be in the Albuquerque area (approximately 1.2 percent increase in the total population). The Colorado Springs increase would be approximately 1.6 percent in the total population. These impacts should not be significant since the proposed action is phased over a three year period and because the Great Falls and Colorado Springs areas are experiencing population reductions from other Air Force actions. Adequate housing, schools, and community services should be available.

3.1.10 Recommendations. Based upon this preliminary analysis, Malmstrom appears to be the most environmentally preferred location and Colorado Springs the least environmentally preferred. In view of the military construction program schedule being developed in support of the proposed action (FY 82 MCP), because of the preliminary nature of this analysis, AFSC should immediately begin actions for the preparation of a proposed Draft Environmental Impact Statement (EIS) for each of the candidate sites. This proposed draft EIS should be developed in accordance with AFR 19-2, Environmental Impact Analysis Process, published in the Federal Register, Vol. 44, No. 145, July 26, 1979. Procedures established in AFR 19-2 for "scoping" must be followed. The proposed draft EIS must be forwarded to HQ USAF for AF/LEEV to determine whether the statement should

be filed with EPA as a draft. If it is determined that the proposed action requires a Draft and Final EIS, approximately 13 months may be required for completion of the environmental impact analysis process.

3.2 Environmental Analysis for Malmstrom AFB. In assessing the potential environmental impacts at Malmstrom AFB, several other actions presently occurring at Malmstrom were considered. These actions include: (1) Inactivation of the 17th Defense System Evaluation Squadron (DSES); (2) Completion of the Boeing Company modification to the Minuteman missiles; (3) Inactivation of the 24 AD/NORAD Region.

3.2.1 Personnel Actions: Net cumulative personnel changes for the proposed action, inactivation of the 17th DSES, inactivation of the 24 AD/NORAD, and Boeing are as follows:

	CSOC[1]	17th DSES[2]	24AD/NORAD[3]	Boeing[4]	Net Change
Officer	+108	-59	-94	0	-45
Enlisted	+245	-327	-421	0	-503
DAF Civilian	+110	-12	-51	0	+47
Contractor	+1441	0	0	-1400	+41

Implementation completion dates for the above actions are as follows:

17th DSES	Oct 79
24AD/NORAD	Sep [illegible]
Boeing	Feb 80
CSOC	1985

3.2.2 Basis for Analysis: As shown from the cumulative net personnel changes, the on-base and off-base population changes from the proposed action are not significant. The projected base population for 1985 (after the proposed action is completed) will still be less than the base population (by approximately 460 personnel) on 31 March 1978.[5] With the time and resources available, those environmental attributes in the Air Force Environmental Reference (AFERN) system where a potential for significant impact existed were evaluated. The existing conditions for both on-base and off-base (Cascade County) were considered.

3.2.3 Region of Influence (ROI): The region of influence for Malmstron AFB is Cascade County which encompasses the City of Great Falls and is where the majority of base employees reside.

3.2.4 Water: Malmstrom AFB receives all of its potable water from the City of Great Falls. The present average daily consumption is 86.5 gallons per capita per day or 1.2 million gallons per day (MGD). The City of Great Falls Water Treatment Plant has the capacity to produce 50 MGD. The present average water demand on the city plant is 14 MGD. For a "worst case" analysis (not including the 17th DSES, 24 AD/NORAD and Boeing reductions), the proposed action would result in a population increase of approximately 5,360 people (including contractor personnel and dependents) in the Cascade County Area. The maximum water increase would be 0.94 MGD which can be accommodated by the existing plant capacity. However, since personnel reductions would also be realized from the actions discussed, the impacts from the proposed action would be even less significant.

3.2.5 Wastewater: At the present time, all sewage on Malmstrom AFB is treated at the Base Wastewater Treatment Plant. The effluent, however, does not meet National Pollutant Discharge Elimination System (NPDES) criteria and plans are to connect to the city regional system.[6]

The Great Falls Municipal Wastewater Treatment Plant meets all NPDES requirements. The plant has a 20-MGD capacity and a present load of 11 MGD. Malmstrom AFB should be connected to the regional system before implementation of the proposed action in 1983. All NPDES criteria would be met and any increase in sewage flow from the proposed action (unlikely since there will be an overall base population reduction in 1983) could be accommodated. In the "worst case" analysis, the addition of 5,360 people to the Cascade County area would use a small fraction (6.2%) of the excess capacity at the City's plant.

3.2.6 Solid Waste: All solid waste from Malmstrom is disposed of in a city sanitary landfill. Malmstrom AFB is also participating in an overall county solid waste management regional study.[7] There are adequate landfill sites in Cascade County to accommodate the "worst case" analysis of an added 10 tons of solid waste per day.

3.2.7 Air: Except for a small area in Great Falls which is a nonattainment area (one monitoring station) for particulates, the ROI is well within the criteria standards for all pollutants. The county feels this nonattainment is not a significant problem and can be controlled by street cleaning. There have been no air pollution episodes, as the area is lightly populated and there is no heavy industry.[8] Air pollutants will be principally from vehicles and diesel generators. However, with the corresponding population

decreases from the other actions at Malmstrom, there should be no significant impact to the air quality.

3.2.8 Electromagnetic Radiation (EMR) Impacts[9]: This reference identifies a potential hazard zone for aircraft at Malmstrom during peak power operation. The mitigating measure suggested in the reference must be explained. Because of the increased public interest in the potential hazards of EMR to base personnel and the general public, a more detailed analysis is required.

3.2.9 Utilities: Heating is provided at Malmstrom by gas-fired heating plants. Since natural gas in the future may be in short supply, plans are underway to construct a central coal-fired heating plant. A proposed draft environmental impact statement for this plant is being prepared.[6] Malmstrom receives its electrical power from the Montana Power Company. Cascade County system capacities for both heating and electrical power are adequate to satisfy the proposed action. However, there may be a problem with the continued availability of natural gas. Construction of a coal-fired heating plant is planned, but at the present time is not funded in any specific fiscal year. Power requirements for the proposed action will require increasing electrical capacity to the base from the city.

3.2.10 Construction Impacts: To support this proposed action, approximately 434,000 SF of new construction or approximately six new facilities including an antenna farm are required. This is the maximum new construction being planned and the actual requirement may be less. Use of existing facilities is also being considered. The construction will be located on 135-acre site with an additional 1,000 ft buffer zone around the site (for a total of approximately 400 acres). The proposed site is on base undeveloped land. Construction would include utility lines to the site. There could be significant impacts from this construction.

3.2.11 Socioeconomic:

3.2.11.1 Population: The present population of Cascade County is approximately 88,170. The present population growth rate is about 1,000 persons per year.[6] The proposed action would increase the Cascade County population by 5,360 or by 6.0%. This also represents about six years' growth in three years. However, this impact is offset with the reduction of personnel from the other actions mentioned.

3.2.11.2 Schools: There is a present decline in

school enrollments in the county, and five elementary schools were closed in 1979. Enrollment for the 1979 school year declined by about 1,000 students.[6] Existing schools in the county are adequate to handle students from the proposed action. If required, closed schools could be reopened.

3.2.11.3 Housing: At the present time, there are 23,950 housing units in Cascade County. Vacancy rate averages 10%. Approximately 1,300 housing units are presently vacant. Rental housing for the younger airmen is in short supply. There are many small areas in the County which are available for subdivision development.[6] Although the proposed action is phased over a three year period, the action may have a significant impact upon the housing market for higher priced homes due to higher paid contractor personnel.

3.3 Environmental Analysis for Peterson AFB: In assessing the potential environmental impacts from the proposed action at Peterson AFB, the personnel reductions from the reorganization of ADCOM in the Colorado Springs area were also considered.

3.3.1 Personnel Actions:

Peterson AFB

	Present Base[10] Pop	ADCOM[11] Reorg	This Action[1]	Total	Net Change
Officer	257	+237	+108	602	+345
Enlisted	1453	-101	+245	1597	+144
Civilian	848	+169	+110	1127	+279
Contractor	-	-	+1441	1441	+1441
	2558	+305	+1904	4769	+2209

Colorado Springs, CO

	ADCOM[11] Reorg	This Action	Net Change
Total Population (Including Dependents)	-3500	+5360	+1860

3.3.2 Basis for Analysis: A preliminary environmental analysis was prepared by SAMSO.[8] The original analysis was based upon the project facilities to be sited on vacant land just north of the base next to the base housing area and in the vici.ity of the north entrance. The site is base-owned. However, because of limitations on this site, it is now proposed to use another area

approximately six to ten miles east of Peterson AFB. ADCOM/DE advises that these parcels of land are state or privately owned and can be obtained at moderate cost. There is adequate acreage available to satisfy all operational and EMR hazard criteria. Little is known about these locations from an environmental perspective. Also, since the site survey team members were instructed not to contact personnel off-base for any information, the proposed site could not be fully assessed as to potential environmental concerns. However, it does not appear that there will be any significant environmental impacts on Peterson AFB by the use of the off-base site.

3.3.3 Natural Environment:

3.3.3.1 Project Site

3.3.3.1.1 Land Use. The proposed project sites are presently agricultural land used for grazing. The proposed action requires approximately 400 acres (107 acre site with 1,000 ft buffer zone around the site). The proposed action will change the land use. It does not appear that the area has any endangered flora or fauna but this should be further evaluated. The land-use change may affect hunting or other wildlife activities.

3.3.3.1.2 Water. Water availability to the proposed site may be a problem. No verified information could be obtained as to the availability of ground water on the project site. Unofficial information indicated that sufficient water may not be available and a pipeline may be required.

3.3.3.1.3 Electrical. Adequate electrical power must be extended to the project site.

3.3.3.1.4 Natural Gas: No gas lines are available on the site, and lines would have to be brought into the area.

3.3.3.1 5 Wastewater. It is assumed that wastewater would be treated by sewage lagoons rather than constructing a sewage main to the city sewage treatment plant.

3.3.3.1.6 Electromagnetic Radiation (EMR) Impacts. Discussion with SAMSO engineers indicate that EMR hazards are minimized due to the remoteness and acreage of the project site. However, because of the increased public interest in EMR hazards, a thorough analysis of this aspect must be prepared.

3.3.3.1.7 Construction Impacts. In addition to the impacts described above, the proposed action will require construction of new facilities totaling approximately 468,000 sq ft. This

construction may significantly affect the entire area surrounding the project site.

3.3.3.2 El Paso County:

3.3.3.2.1 Air Quality[11]: The Colorado Springs urbanized area has been identified as "not meeting primary ambient air quality standards for carbon monoxide (CO) and total suspended particulates (TSP)." El Paso County has been identified as "not meeting primary ambient air quality standards for oxidants (O_x)." The primary air quality impact from the proposed action will be from the increased number of vehicles. The increase is not considered significant and even less when the reductions from the ADCOM reorganization are included.

3.3.3.2.2 Water/Wastewater/Solid Waste. The County has adequate capacities to handle the proposed action increases.

3.3.4 Socioeconomic:

3.3.4.1 Population. The population of El Paso County is approximately 333,000 and the average population growth from 1970-1979 was about 925 persons per month. The proposed action is estimated to add 5,360 persons or about 5.8 months of growth over a three year period. However, if the population reductions from the ADCOM reorganization were included, the impact would be even less significant (2.0 months growth).

3.3.4.2 Housing, Schools, and Community Services. The proposed action represents a 1.6 percent increase to the population in the county. This increase will also be spread over a three year period. Adequate schools, housing, and community services should be available.

3.4 Environmental Analysis for Kirtland AFB

3.4.1 Personnel Actions:

	FY85[10]	This Action[1]	% Increase
Officer	1541	+108	
Enlisted	4409	+245	
Civilian	2788	+110	
Contractor	8100	+1441	
Total	16838	+1904	+11.3%

3.4.2 Basis for Analysis: The proposed project location is in the extreme southeast section of the base approximately seven miles from the main portion of the base. The primary biophysical

impacts from the proposed action should be on the site itself and on the City of Albuquerque.

3.4.3 Natural Environment:

3.4.3.1 Project Site

3.4.3.1.1 Land Use. The proposed project site is located on base and consists of undeveloped grassland (approximately 400 acres). The closest public lands are the US Forest Service property (Cibola National Forest) approximately six miles to the east and the Isleta Indian Reservation approximately three miles to the south. No threatened and endangered species of plant and animal life or critical habitat have been identified on Kirtland AFB.[12]

3.4.3.1.2 Archaeological. Kirtland AFB has conducted an archaeological survey on approximately 4,800 of its 46,000 acres. This project was undertaken in compliance with legal requisites of Executive Order 11593, which requires a cultural resource inventory of all military reservations and the 1974 Archaeological and Historic Preservation Act (Public Law 93-291) which requires that an archaeological clearance be obtained prior to certain land disturbing activities undertaken with the use of federal funds. The survey resulted in archaeological finds and recommended that ten specific archaeological areas were significant enough for nomination to the National Register.[13] The closest archaeological find is approximately one mile from the proposed project site. The archaeological survey should be extended to cover the proposed project site location for any archaeological finds on the site. Since the potential exists for archaeological features being on the project site, the survey should be conducted as soon as possible (should Kirtland be selected as the preferred site).

3.4.3.1.3 Air Quality. Air emissions from the proposed action on the project area are limited to vehicle emissions and emissions from diesel generators and fuel oil for heating. Although these are not considered significant, an analysis should be made to determine whether the Prevention of Significant Deterioration Provisions of the State of New Mexico Implementation Plan[14] are affected.

3.4.3.1.4 Utilities. Adequate water, wastewater, and electrical power facilities are available from the main base.

3.4.3.1.5 Electromagnetic Radiation (EMR) Impacts. EMR hazards are minimized due to the remoteness and acreage of the project site. However, because of the increased public interest in EMR hazards, a thorough analysis of this concern must be

prepared. All mitigating measures to minimize the hazards should also be discussed.

3.4.3.1.6 Construction Impacts. To support this proposed action, existing facilities in the Manzano area will be modified. In addition to this modification, approximately 370,000 sq ft of major new construction will be required.

3.4.3.2 City of Albuquerque

3.4.3.2.1 Air Quality. The City of Albuquerque is a nonattainment area for carbon monoxide (CO) and total suspended particulates (TSP).[14] The proposed action could add to the problem with the increase of automobiles (approximately 3,000) into the area. However, based upon figures available, this increase is less than one percent of the vehicles in the Albuquerque area.

3.4.3.2.2 Utilities. The City of Albuquerque has adequate utility capacities to satisfy the increased requirements from the population increase.

3.4.4 Socioeconomic:

3.4.4.1 Population. The population of the City of Albuquerque is approximately 425,000.[15] The average population growth is approximately 858 persons per month. The proposed action is estimated to add approximately 5,360 persons or about 6.2 months of growth over a three year period.

3.4.4.2 Housing, Schools, Community Services. The proposed action represents a 1.2 percent increase to the population in Albuquerque. The increase will occur over a three year period. Therefore, there should be no significant impact.

ENVIRONMENTAL ANALYSIS
REFERENCES CITED

1. Memorandum for Record. Manning/Facility Requirements, Maj Byrne/RDSL, 22 Aug 79.

2. Environmental Assessment for Inactivation of the 17th Defense Systems Evaluation Squadron (DSES), ADCOM at Malmstrom AFB, MT, 15 February 1979, prepared by 2Lt Clifford Fetter.

3. Environmental Assessment for Inactivation of the 24th Air Division/NORAD Region, ADCOM at Malmstrom AFB MT, 29 January 1979, prepared by 2Lt Clifford Fetter, as amended by HQ SAC.

4. Discussion with 2Lt Fetter, Base Environmental Coordinator, Malmstrom AFB, 5 September 1979.

5. "Resource Statement," Commander's Facts Book, 31 March 1978.

6. TAB -1, Environmental Narrative, Malmstrom AFB, MT, 15 Aug 77.

7. Solid Waste Management Study, Lower Triangle Region of Montana, July 1979.

8. Central Heating Plant, Malmstrom AF Prevention of Significant Deterioration Application, August 1979.

9. Volume IV Supplement, Environmental Analysis, Department of the Air Force, Space and Missile Systems Organization, Air Force Systems Command, 16 Mar 79.

10. Baseline information provided by AF/MPM.

11. Formal Environmental Assessment for the Proposed Reorganization of the USAF Air Defense and Surveillance Warning Resources, Revised 11 July 1979.

12. TAB A-1, Environmental Narrative, Kirtland AFB, Revised January 1979.

13. An Intensive Archaeological Survey of a Portion of Kirtland AFB, NM, November 8, 1978.

14. State of New Mexico, Implementation Plan for the Attainment and Maintenance of National Ambient Air Quality Standards, January 1979.

15. Formal Environmental Assessment for the Proposed Realignment/Reduction of the Air Force Departmental Headquarters, HQ USAF, 9 Apr 78

CHAPTER IV

FINDINGS

4.0 Each site was evaluated against the previously established 16 criteria with special emphasis on using, to the maximum extent possible, existing available facilities to decrease new construction costs. Added emphasis was given to evaluating each location's ability to assume the base operating support responsibilites of the CSOC mission. Additionally, an informal environmental analysis was performed at each location. The following paragraphs highlight the significant findings of the survey.

4.1. Malmstrom AFB, Montana. The primary advantages offered by Malmstrom are the use of existing facilities, its ability to absorb future missions, and its environmentally preferred location. Due to the inactivation of existing ADCOM and NORAD units, the SAGE facility (Bldg 500) can be effectively used for CSOC Engineering and Administration requirements, but a new technical facility would be required. Additionally, the inactivation also allows the Malmstrom base operating support functions to assume CSOC mission requirements with little to no impact. However, these advantages are offset by area construction cost factors making Malmstrom the highest in facility costs of the three sites. Although the antenna location represents no EMR hazard to aircraft or missile EED units under normal operating power levels, at planned power levels, future antenna systems may produce an EED hazard zone which violates the runway air traffic safety zone.

4.2. Peterson AFB, Colorado. The primary advantages offered by Peterson are the operational and organizational advantages which increase the effectiveness and efficiency, while decreasing the life cycle costs, of the CSOC (see Annex C). The geographical proximity of CSOC to the Space Defense Operations Center (SPADOC) provides a foundation for significant, long-term operational efficiencies stemming from convenient, face-to-face planning as well as shared technical support assets and the flexibility to accomodate future organizational changes. For these reasons, the life cycle cost of CSOC is the lowest at Peterson. In addition, Peterson offers modern base operating support facilities. However, because of the lack of available existing facilities, the CSOC is an entirely new facility negating the opportunity to reduce MCP costs. Additionally, acreage must be acquired east of Peterson in order to meet the CSOC requirements. Except for 10,000 SF of possible CSOC storage

located at Peterson AFB, the entire CSOC facility would be located east of the base on Colorado State land. Exclusive of land acquisition, Peterson would have the second highest facility costs.

4.3. Kirtland AFB, New Mexico. Kirtland AFB offers the use of available existing facilities and is the most geographically secure site. The Manzano area of Kirtland has (seven) unused buildings that can be used for CSOC Engineering and Administration requirements. A new technical building would have to be constructed and the antenna system would be located remote from the CSOC facility. The use of existing facilities coupled with the lowest area construction cost factor makes Kirtland the lowest in total facility costs of the three candidate sites. The principal disadvantage is that the Sandia and Manzano mountains present marginal viewing conditions to the east for baseline CSOC antenna systems and violate the 5 degree minimum elevation angle for planned CSOC antenna systems in portions of the north, east, and west horizon.

TABLE 2

SUMMARY OF FINDINGS

ADVANTAGES	DISADVANTAGES
MALMSTROM AFB, MONTANA	
- Uses Existing Facilities for E&A	- Potential EMR Hazzard
- Meets Base Support Requirements	- Technical Support Base Marginal for Support of Technical Personnel
- Most Compatible Environment	- Intercity Transportation is Marginal
	- Not within TDRSS Footprint
	- No WESTPAC Coverage
	- Highest Initial Estimated MCP Costs
PETERSON AFB, COLORADO	
- Shares Technical Support Assets with SPADOC	- Located on Non-Federal Land
- Lowest Life Cycle Cost	- Limited Available Facilities
- Meets Base Support Requirements	- No WESTPAC Coverage
- Exceptional Technical Support	- Not within
	- Second Highest Initial Estimated MCP Costs
KIRTLAND AFB, NEW MEXICO	
- Uses Existing facility for E&A	- Obscura potentially limits projected mission operations
- Lowest Initial MCP Costs	- Marginally meets RF quiet criteria
- Meets Base Support Requirements	- No WESTPAC Coverage
- Meets Technical Support Base Standards	
- Most Geographically Secure	

APPENDIX A

GLOSSARY OF TERMS

ADC	Aerospace Defense Center
A-E	Architect-Engineer
AFB	Air Force Base
AFS	Air Force Station
AFSC	Air Force Systems Command
AFSCF	Air Force Satellite Control Facility
AFSS	Air Force Security Service
ASC	AUTODIN Switching Center
ASD	Aeronautical Systems Division
AUTOSEVOCOM	Automatic Secure Voice Communications
AUTODIN	Automatic Digital Information Network
AUTOVON	Automatic Voice Network
ASPR	Armed Services Procurement Regulation
BOQ	Bachelor Officers Quarters
BOS	Base Operating Support
CBPO	Consolidated Base Personnel Office
CCPO	Consolidated Civilian Personnel Office
CEQ	Council on Environmental Quality
CES	Candidate Environmental Statement
CONUS	Continental United States
CSOC	Consolidated Space Operations Center--Consolidates both Satellite & Shuttle Operations functions
CY	Calendar Year
DCA	Defense Communications Agency
DES	Draft Environmental Statement

DLT	Data Link Terminal
DMJM	Daniel, Mann, Johnson and Mendenhall
DOD	Department of Defense
DOMSAT	Domestic Satellite
DSCS	Defense Satellite Communications System
DSTE	Digital ubscriber Terminal Equipment
DT&E	Development Test and Evaluation
E&A	Engineering and Administration
EASTPAC	Eastern Pacific
ECAC	Electromagnetic Capability Analysis Center
EED	Electro-Explosive Devices
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
EMR	Electromagnetic Radiation
FAMCAMP	Family Camp
FES	Final Environmental Statement
FOV	Field-Of-View
FY	Fiscal Year
GHz	Gigahertz
GTS	Guam Tracking Station
HQ	Headquarters
HTS	Hawaii Tracking Station
IAP	International Airport
ICBM	Intercontinental Ballistic Missile
IOC	Initial Operating Capability

GLOSSARY OF TERMS (Continued)

LOGAIR	Logistics Air
MCP	Military Construction Program
MWR	Morale, Welfare, and Recreation
NASA	National Aeronautical and Space Administration
O&M	Operations and Maintenance
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Agency
OT&E	Operational Test & Evaluation
RFI	Radio Frequency Interference
RTS	Remote Tracking Station
SAGE	Semi-Automatic Ground Environment
SAMSO	Space and Missile Systems Organization
SATCOM	Satellite Communication
SCDRS	Satellite Control and Data Relay System
SECORD	Secure Switchboard
SOC	Satellite Operations Center (Portion of CSOC)
SOPC	Shuttle Operations and Planning Center portion of CSOC
SPADOC	Space Defense Operations Center
SPO	System Program Office
STC	Satellite Test Center
STC II	Satellite Test Center Two, Now Known as Satellite Operations Center (SOC) Portion of CSOC.
TAC	Tactical Air Command
TBD	To be Determined
TDY	Temporary Duty

APPENDIX B
INITIAL ESTIMATED MCP
SITE COSTS

3.1 Methodology: The CSOC facility estimated costs were developed during the site survey by the A&E contractor based upon a conceptual baseline and are Rough Order of Magnitude (ROM) only. The conceptual baselines were generated from site peculiar location and configuration requirements. The costs are computed using DOD area construction cost factors based upon a Los Angeles cost factor of 1.0. These cost factors are:

- Malmstrom AFB, Great Falls, Montana - 1.04

- Peterson AFB, Colorado Springs, Colorado - .88

- Kirtland AFB, Albuquerque, New Mexico - .86

The costs shown are in FY 78 dollars with FY 82 dollars in parenthesis, computed using an escalation factor of 1.39. The site costs were developed to show the comparative costs and cost relationships between sites, and are not intended to show absolute values. Every attempt was made to insure consistency in costing from site to site for comparative cost purposes. The following paragraphs first reflect a summary of the total cost, and second, a summary cost breakdwon of each of the candidate sites.

3.2 Summary Estimated Costs

3.2.1 Malmstrom AFB

Option A (SAGE and New Tech Bldg + Remote Antenna Field) = $80M ($111.2M)

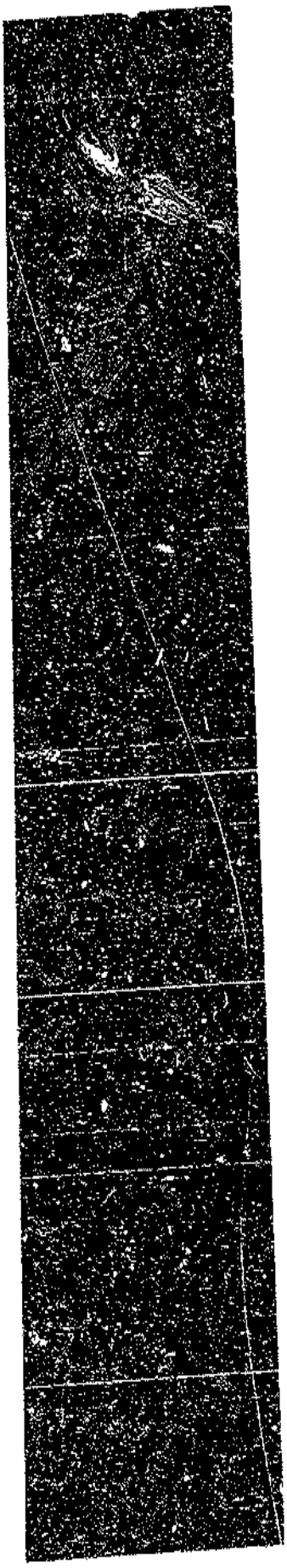
Option B (New Facility with Bldgs 145 & 1445 + Collocated Antenna) = $86M ($119.5M)

3.2.2 Peterson AFB

New Facility East of PAFB = $78M ($109.0M)
Does not include land acquisition costs.

3.2.3 Kirtland AFB

Manzano Facility + Remote Antenna Field = $68.5 ($95.1M)



3.3 Summary Estimated Cost Breakdown

3.3.1 Malmstrom AFB

Option A:

CSOC Baseline Buildings	$71.5M
Utilization of Existing Facilities	
- Value of Space Saved	<10.2>
- Cost of Modification	3.7
Site Peculiar Preparation	7.3
EMP Protection	7.7
CSOC Total	$80.0M ($111.2M)

Option B

CSOC Baseline Building	$71.8M
Utilization of Existing Facilities	
- Value of Space Saved	<4.0>
- Cost of Modification	.4
Site Peculiar Preparation	9.9
EMP Protection	7.9
CSOC Total	$86.0M ($119.5M)

3.3.2 Peterson AFB

CSOC

CSOC Baseline Building	$60.6M
Utilization of Existing Facilities	
- Value of Space Saved	<.63>
- Cost of Modification	.03

Site Peculiar Prepearation	11.4
EMP Protection	6.6
CSOC Total	$78.0M ($109.0M)

3.3.3 Kirtland AFB

CSOC

CSOC Baseline Building	$59.0M
Utilization of Existing Facilities	
- Value of Space Saved	<6.3>
- Cost of Modification	2.0
- Site Peculiar Preparation	7.3
EMP Protection	6.4
CSOC Total	$68.4M (95.1M)